

Asia Communications and Photonics Conference (ACP) 2017

10–13 November 2017

The Garden Hotel, Guangzhou, Guangdong, China

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Welcome to Guangzhou and to the Asia Communications and Photonics Conference

It is a great pleasure to invite you to participate in the Asia Communications and Photonics Conference (ACP) 2017 and share the latest news in communications and photonics science, technology and innovations from leading companies, universities and research laboratories throughout the world. ACP is now the largest conference in the Asia-Pacific region on optical communication, photonics and relevant technologies. ACP has been held annually tracing back to 2001 and jointly sponsored by OSA, SPIE, IEEE Photonics Society, COS and CIC.

The ACP technical conference features a full suite of plenary, invited, and contributed talks given by international academic and industrial researchers who are leaders in their respective fields. This year's conference will feature the following topics: Optical Fibers and Fiber-based Devices; Optical Transmission Systems and Networks; Photonic Devices, Components, and Photonic Integration; Microwave Photonics; Micro-Nano, and Ultrafast Photonics: Science and Applications; Light Emitting Materials, Devices, and Applications; Photonics for Energy; Photonics for Biology and Medicine. The conference will also include a wide spectrum of workshops and industrial forums taking place on 10 November. With a conference program of broad scope and of the highest technical quality, ACP provides an ideal venue to keep up with new research directions and an opportunity to meet and interact with the researchers who are leading these advances. We have over 600 papers scheduled, including nearly 120 invited and 10 tutorial presentations made by many of the world's most prominent researchers from academia and industry. We thank all the contributors and

authors for making ACP a truly unique, outstanding global event.

Our conference highlight is the Plenary Session scheduled on the morning of Saturday, 11 November. Five outstanding, distinguished speakers will give presentations: David N. Payne, *Univ. of Southampton, UK* will give a talk on No Payne Without Gain. Eric Mazur, *Harvard Univ., USA* will also present in this session. Connie Chang-Hasnain, *Univ. of California, Berkeley, USA* will discuss VCSEL Arrays for 3D Sensing and Imaging. Peter J. Winzer, *Massachusetts Inst. of Technology, USA* will discuss Future Network Scaling and the Need for Massive Opto-Electronic Array Integration. Finally Dimitra Simeonidou, *Univ. of Bristol, UK* will give a presentation on Ultimate Optical-Wireless Network Convergence: Vision, Architecture and Real-Life Deployments.

In addition to the regular technical sessions, 7 workshops and an Industry Forum on the Advances and Trends of Photonics Integration will feature an additional 73 speakers. Pre-conference workshops will be held on Friday, 10 November starting at 09:00. These workshops will be held free of charge to conference registrants. We would like to thank the workshop organizers and speakers for the excellent program.

Best Student Paper Awards sponsored by OSA will be given to students who are first authors and presenters of exceptional contributed talks. This year, the State Key Laboratory of Optoelectronic materials and Technologies (the OEMT), Sun Yat-sen University, will sponsor the Best Paper Awards and Best Poster Awards. The selection will be made by the subcommittees during the conference. Awards will be

presented during the Banquet on Sunday, 12 November. The poster-only session will be held on Sunday, 12 November from 10:30–12:30. This is a good chance for you to meet with the authors and discuss technical issues in-depth.

In addition to the technical program, we have also an impressive range of exhibitions from the relevant industries, publishers, and professional organizations.

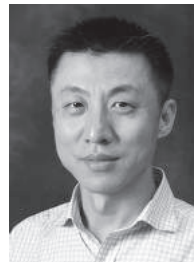
We have also prepared a rich social program to facilitate meeting and networking with colleagues from all over the world. A conference welcome reception will be held in the evening on Saturday, 11 November. On the evening of Sunday, 12 November, we will hold a Banquet and Awards Ceremony for conference registrants.

It is an enormous task to organize a conference and it is impossible to succeed without the dedicated efforts of many supporters and volunteers. We are indebted to the entire Technical Program Committee and the Subcommittee Chairs who have worked persistently throughout the whole year to invite speakers, solicit and review papers, organize the technical sessions which results in the excellent technical program. We also thank the staff and volunteers of Sun Yat-Sen University, South China Normal University, Center China Normal University, SKLLMD, Jinan University, Nanophotonics Research Center, and the Chinese Laser Press. We also wish to thank the professional societies OSA and IEEE Photonics Society, and SPIE for organizing and sponsoring the event.

Sincerely,



Siyuan Yu
Sun Yat-sen University, China
Univ. of Bristol, UK
General Chair



Chao Lu
The Hong Kong PolyTech University, China
General Chair



Xiaoping Zheng
Tsinghua University, China
General Chair

Committees

Honorary Chairs

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Hequan Wu, *China Academy of Information and Communications Technology, China*
Ningsheng Xu, *Fudan Univ., China*
Dianyuan Fan, *Shenzhen Univ., China*

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Chao Lu, *The Hong Kong PolyTech Univ., China*
Xiaoping Zheng, *Tsinghua Univ., China*

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Baiou Guan, *Jinan Univ., China*
Yuguang Ma, *South China Univ. of Technology, China*
Xiaocong Yuan, *Shenzhen Univ., China*
Guofu Zhou, *South China Normal Univ., China*

Steering Committee

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Christine L. Bluhm, *IEEE Photonics Society, USA*
Naomi Chavez, *OSA, USA*
Arthur Chiou, *Yang-Ming Univ., Taipei, China*
Christopher Jannuzzi, *IEEE Photonics Society, USA*
Yun C. Chung, *Korea Advanced Inst. of Science and Technology, Korea*
Connie J. Chang-Hasnain, *Univ. of California, Berkeley, USA*
Sailing He, *Zhejiang Univ., China & KTH, Sweden*
Chennupati Jagadish, *Australian National Univ., Australia*
Thomas L. Koch, *Univ. of Arizona, USA*
Ming-Jun Li, *Corning Inc., USA*
Xingde Li, *Johns Hopkins Univ., USA*
Xiang Liu, *Huawei Technologies, USA*
Chao Lu, *The Hong Kong Polytechnic Univ., China*
Qingming Luo, *Wuhan National Laboratory for Optoelectronics & Huazhong Univ. of Science and Technology, China*
Qian Mao, *Wuhan Research Inst. of Posts and Telecommunications, China*
Ping Perry Shum, *Nanyang Technological Univ., Singapore*

Yikai Su, *Shanghai Jiao Tong Univ., China*
Brian J. Thomas, *SPIE, USA*
Bingkun Zhou, *Tsinghua Univ., China*

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Xiaoping Zheng, *Tsinghua University, China*
Xiaocong Yuan, *Shenzhen University, China*
Zhaohui Li, *Sun Yat-sen Univ., China*
Xinlun Cai, *Sun Yat-sen Univ., China*
Krzysztof (Kris) Kempa, *Boston College, USA and SCNU, China*
Shijian Su, *South China University of Technology, China*

Local Organizing Committee

Yujie Chen, *School of Electronics and Information Technology, Sun Yat-sen University, China, Chair*
Xiangshi Zheng, *State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen University, China, Co-chair*
Xiuyan Lin, *State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen University, China*
Shaojun Ye, *State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen University, China*

Subcommittees

ACP Track 1: Optical Fibers and Fiber-based Devices

Benyuan Zhu, *OFS Labs, USA, Chair*
Xuping Zhang, *Nanjing Univ., China, Co-chair*
Hui Cao, *Yale Univ., USA*
Nicolas Fontaine, *Nokia Bell Labs, USA*
Takemi Hasegawa, *Sumitomo Electric Industries, Ltd, Japan*
Xin Jiang, *City Univ. of New York, USA*
Fan Li, *Sun Yat-Sen Univ., China*
Periklis Petropoulos, *Univ. of Southampton, UK*
Pierre Sillard, *Prysmian Group, France*
Baishi Wang, *Thorlabs, Vytran Division, USA*
Liangming Xiong, *YOFC, China*

ACP Track 2: Optical Transmission Systems and Networks

Chao Lu, *Hong Kong Polytech Univ., China, Chair*
Gangxiang Shen, *Soochow Univ., China, Co-chair*
Hoon Kim, *KAIST, Korea, Co-chair*
Nan Chi, *Fudan Univ., China*
Xiang Zhou, *Google, USA*
Songnian Fu, *Huazhong Univ. of Science and Technology, China*
Lilin Yi, *Shanghai Jiao Tong Univ., China*
Zhaohui Li, *Sun Yat-sen Univ., China*
Qunbi Zhuge, *Ciena, Canada*
William Shieh, *Univ. of Melbourne, Australia*
Qian Hu, *Nokia-Bell Labs, Germany*
Georgios Zervas, *UCL, UK*
Yoshinari Awaji, *NICT, Japan*
Darko Zibar, *Technical Univ. of Denmark, Denmark*

ACP Track 3: Photonic Devices, Components, and Photonic Integration

Hon Ki Tsang, *Chinese Univ. of Hong Kong, China, Chair*
John Marsh, *Univ. of Glasgow, UK, Co-chair*
Xinlun Cai, *Sun Yat-sen Univ., China, Co-chair*
Gunther Roelkens, *Ghent Univ., Belgium*
Yohsiaki Nakano, *Tokyo Univ., Japan*
Liu Liu, *South China Normal Univ., China*
Yu Yu, *Huazhong Univ. of Sci & Tech, China*
Niklos Bamiedakis, *Cambridge Univ., UK*
Patty Stabile, *Technical Univ. of Eindhoven, Netherlands*
Qiang Lin, *Univ. of Rochester, USA*
Chunle Xiong, *Australian National Univ., Australia*
Wei Shi, *Laval Univ., China*
Giampiero Contestabile, *Scuola Superiore Sant'Anna, Italy*

ACP Track 4: Microwave Photonics

Xiaoping Zheng, *Tsinghua Univ., China*, **Chair**
Nathan Gomes, *Univ. of Kent, UK*, **Co-chair**
Zhangyuan Chen, *Peking Univ., China*, **Co-chair**
Arokiaswami Alphones, *NTU, Singapore*
Gee-Kung, Chang, *GTI, USA*
Yi Dong, *Beijing Inst. of Technology, China*
Shanguo Huang, *Beijing Univ. of Posts and Telecommunications, China*
Ming Li, *Inst. of Semiconductors, Chinese Academy of Sciences, China*
Wangzhe Li, *Inst. of Electrics, Chinese Academy of Sciences, China*
Yifei Li, *Univ. of Massachusetts Dartmouth, USA*
Guo-Wei Lu, *Tokai Univ., Japan*
Borja Vidal Rodriguez, *Universitat Politècnica de València, Spain*
Iezekiél Stavros, *Univ. of Cyprus, Cyprus*
Eduward Tangdiongga, *Eindhoven Univ. of Technology, The Netherlands*
Xianbin Yu, *Zhejiang Univ., China*
Xiaoxiao Xue, *Tsinghua Univ., China*

ACP Track 5: Micro-, Nano-, and Ultrafast Photonics: Science and Applications

Xiaocong Yuan, *Shenzhen Univ., China*, **Chair**
Min Qiu, *Zhejiang Univ., China*, **Co-chair**
Chengwei Qiu, *Shenzhen Univ., China*, **Co-chair**
Ya Cheng, *East China Normal Univ., China*, **Co-chair**
Yves Belluard, *Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland*
Yangjian Cai, *Soochow Univ., China*
Yujie Chen, *Sun Yat-Sen Univ., China*
Yijun Feng, *Nanjing Univ., China*
Min Gu, *RMIT Univ., Australia*
Jun He, *Central South Univ., China*
Peter Herman, *Univ. of Toronto, Canada*
Dangyuan Lei, *The Hong Kong Polytechnic Univ., China*
Guixin Li, *Southern Univ. of Science and Technology, China*
Xiangping Li, *Jinan Univ., China*
Zhaowei Liu, *Univ. of California, San Diego, USA*
Asger Mortensen, *Technical Univ. of Denmark, Denmark*
Stefan Nolte, *Friedrich-Schiller-Univ. Jena, Germany*
Siddharth Ramachandran, *Boston Univ., USA*
Michael Somekh, *The Hong Kong Polytechnic Univ., China*
Din Ping Tsai, *National Taiwan Univ., Taipei, China*

Paul Urbach, *Delft Univ. of Technology, The Netherlands*
Huitian Wang, *Nanjing Univ., China*
Jian Wang, *Huazhong Univ. of Science and Technology, China*
Jianfang Wang, *Chinese Univ. of Hong Kong, China*
Yunfeng Xiao, *Peking Univ., China*
Anatoly Zayats, *King's College London, UK*
Qiwen Zhan, *Univ. of Dayton, USA*
Lei Zhou, *Fudan Univ., China*

ACP Track 6: Light Emitting Materials, Devices, and Applications

Shijian Su, *South China Univ. of Technology, China*, **Chair**
Xiaohong Zhang, *Soochow Univ., China*, **Co-chair**
Xiaowei Sun, *Southern Univ. of Science and Technology, China*, **Co-chair**
Xiaogang Peng, *Zhejiang Univ., China*, Co-chairs
Chun-Sing Lee, *City Univ. of Hong Kong, China*
Lian Duan, *Tsinghua Univ., China*
Guoqiang Li, *South China Univ. of Technology, China*
Jianpu Wang, *Nanjing Tech Univ., China*
Yizheng Jin, *Zhejiang Univ., China*

ACP Track 7: Photonics for Energy

Krzysztof (Kris) Kempa, *Boston College, USA and SCNU, China*, **Chair**
Mike J. Naughton, *Boston College, USA*, **Co-chair**
Jinwei Gao, *South China Normal Univ., China*, **Co-chair**
Michael Giersig, *Freie Universitaet Berlin, Germany*, **Co-chair**
Paul Mulvaney, *Univ. of Melbourne, Australia*
Liming Ding, *NCNT, Beijing, China*
Chuanfei Guo, *SUSTech, Shenzhen, China*
Hans Joachim Lewerenz, *California Inst. of Technology, USA*
Liang Li, *Soochow Univ., China*
Haibo Zeng, *Nanjing Univ. of Science and Technology, China*
Zhixiang Wei, *National Center for Nanoscience and Technology, China*

ACP Track 8: Photonics for Biology and Medicine

Da Xing, *South China Normal Univ., China*, **Chair**
Valery V. Tuchin, *Saratov State Univ., Russia*, **Co-chair**
Qingming Luo, *Wuhan National Laboratory for Optoelectronics & Huazhong Univ. of Science and Technology, China*, **Co-chair**
Xingde Li, *Johns Hopkins Univ., USA*, **Co-chair**
Jürgen Popp, *Friedrich Schiller Univ. Jena, Germany*
Dick Sterenborg, *Academic Medical Centre, Netherlands*
David Sampson, *Univ. of Western Australia, Australia*
Steven Jacques, *Oregon Health & Science Univ., USA*
Huabei Jiang, *Univ. of Florida, USA*
Junle Qu, *Shenzhen Univ., China*
Zihua Ding, *Zhejiang Univ., China*
Hong Liu, *The Univ. of Oklahoma, USA*
Ruikang Wang, *Univ. of Washington Seattle, USA*
Shaoqun Zeng, *Huazhong Univ. of Science and Technology, China*
Xunbin Wei, *Shanghai Jiao Tong Univ., China*
Jianxin Chen, *Fujian Normal Univ., China*
Sihua Yang, *South China Normal Univ., China*

General Information

Conference Venue: The Garden Hotel Guangzhou

Address: 368 Huanshi Dong Lu, Yuexiu District Guangzhou, 510064, China



Accessibility

The Garden hotel is a luxury hotel in the city center of Guangzhou in the People's Republic of China, The Garden Hotel Guangzhou is centrally located on Huanshi Dong Lu, in the heart of Guangzhou's prosperous business district, only 35 kilometres from Guangzhou Airport. The hotel is less than 15 minutes away from the Trade Fair Centre, and within easy reach of many attractions of Guangzhou such as Shamian Island and the colourful Qingping Market, as well as some of the city's best shopping, dining and entertainment.

Transportation

From Guangzhou Baiyun International Airport

By Airport Line: Take Airport Express Line 2A to Garden Hotel Station (approximately 1 hour 30 min, 20RMB).

By Subway; Take Subway Line 3 (North Extension Section) from Airport South Station to Jiahe Wanggang Station. Transfer to Line 2 to Guangzhou Railway Station. Transfer to Line 5 to Taojin Station. You will need to walk to the hotel from Taojin Station (approximately 1 hour, 7 minutes, 7 RMB)

By Taxi: 35 km to Garden Hotel (approximately 40 minutes, 127RMB)

From Guangzhou Railway Station

By Subway: Take Line 5 from Guangzhou Railway Station to Taojin Station then walk to the Hotel (approximately 10minutes, 2RMB)

By Taxi: 3.5 km to Garden Hotel (approximately 6 minutes, 13RMB)

From Guangzhou South Railway Station

By Subway: Take Line 2 from Guangzhou South Railway Station to Guangzhou Railway Station. Transfer to Line 5 to Taojin Station. Walk from the Taojin Station to the Hotel (approximately 1 hour, 6RMB).

By Taxi: 26km to Garden Hotel (approximately 45 minutes, 70RMB)

From Hong Kong International Airport

By Shuttle: Proceed to Counters C10 - C14, Coach Station, Terminal 2 then purchase tickets at Mainland Coach Service and take the shuttles to Garden Hotel Guangzhou (approximately 3 hours, 30 min, 250RMB)

From Shenzhen Bao'an International Airport

Take a taxi to Shenzhen North Railway Station (approximately 33km, 50 minutes, 90RMB). Then take a high-speed train to Guangzhou South Railway Station. Use either subway or taxi to travel from Guangzhou South

Railway Station to the hotel. Details of travel from Guangzhou South Railway Station are listed above.

Registration

Location: Garden Hotel Lobby

Hours:

08:30–18:00	Friday, 10 November
08:00–18:00	Saturday, 11 November
08:00–18:00	Sunday, 12 November
08:00–16:00	Monday, 13 November

Speaker Preparation

All oral presenters should check in at the corresponding session room at least thirty minutes prior to their scheduled talk to upload and check their presentation. **No shows of the oral presentation will be reported to Conference management and these papers will not be published.**

Poster Preparation

Authors should prepare their poster before the poster session starts. The poster must not exceed the boundaries of the display board and A0 size is recommended. Authors are required to be standing by their poster for the duration of their allocated session to answer questions and further discuss their work with attendees. **No shows will be reported to Conference management and these papers will not be published.**

Poster Board Size – 1m (Length) * 2.235m (Height)

Set-up Time: Saturday, 11 November from 12:00–20:00

Tear-down Time: Monday, 12 November from 12:30–18:00

Exhibition

The ACP Exhibition is open to all attendees.

Location: Exhibition area outside the garden grand ball room. 1F. the Garden Hotel, Guangzhou

Hours:

09:00–12:30	Saturday, 11 November
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Location: Corridor & public area, 3F, the Garden Hotel, Guangzhou

Hours:

13:00–18:00	Saturday, 11 November
09:00–18:00	Sunday, 12 November
09:00–16:00	Monday, 13 November

Coffee Breaks

10:30–11:00	Friday, 10 November
15:30–16:30	Friday, 10 November
10:30–10:45	Saturday, 11 November
15:30–16:00	Saturday, 11 November
10:30–12:30	Sunday, 12 November
16:00–16:30	Sunday, 12 November
10:30–11:00	Monday, 13 November
15:30–16:00	Monday, 13 November

Conference Materials

ACP 2017 Technical Digest will be provided in a USB drive and not available in print form. The ACP 2017 Technical Digest material is composed of the 3-page summaries of invited and accepted contributed papers. The Technical Digest material is included with a technical conference registration and can be found in your registration bag. The Digest will be available on OSA Publishing's Digital Library (<https://www.osapublishing.org/>) and IEEE Xplore Digital Library (<http://www.ieee.org/web/publications/xplore/>) after the conference. IEEE Xplore Digital Library and OSA Publishing's Digital Library are archived and indexed by INSPEC R and EI Compendex, where it will be available to the international technical community.

Social Activities

Welcome Reception

The ACP 2017 Welcome Reception will be held on Saturday, 11 November. It is free to all the registered participants. A ticket is provided within the badge. And extra ticket could be purchased at the Registration Desk for 300RMB per person.

Location: The Grand Ball Room, 1F, The Garden Hotel

Time: 18:30–21:30

Conference Banquet and Awards Ceremony

The ACP 2017 Banquet and Awards Ceremony will be held on Sunday, 12 November. The OSA Best Student Paper Awards, The OEMT Best Paper Awards, and The OEMT Best Poster Awards will be presented at the banquet.

The Banquet is NOT INCLUDED in the registration fee for students, but is included for all other regular registration types. The ticket is provided within the badge. Additional tickets for the banquet can be purchased at the registration desk for 500RMB per person.

Location: The Grand Ball Room, 1F, Garden Hotel

Time: 18:30–21:30

Conference Highlights

Plenary Presentations

Time: 08:00–11:30, Saturday, 11 November

Venue: Garden Grand Ballroom, The Garden Hotel

ACP 2017 will feature five plenary presentations. The presentations will be preceded by an Opening Ceremony from 08:00 – 08:15. For more information about the individual presenters, talk titles and biographies appear below.

No Gain Without Payne

08:15–09:00

David N. Payne

ORC, Univ. of Southampton, UK
Nanyang Technological University, Singapore

Biography: Professor Sir 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. Currently, his main research interest is high-power fibre lasers. With US funding, he led the team that broke the kilowatt barrier for fibre laser output to international acclaim and now holds many other fibre laser performance records. An original member of the Highly Cited Researchers (USA) he is honoured as one of the most referenced, influential researchers in the world. He has published over 650 Conference and Journal papers and is a frequent plenary and invited speaker at major international optics conferences. As an entrepreneur David's activities have led to a cluster of 11 photonics spin out companies in and around Southampton - helping to



boost the local economy. He founded SPI Lasers PLC, which has recently been purchased by the Trumpf Corporation of Germany for \$40M. Recently elected Chairman of the Marconi Society and to the Russian Academy of Sciences, David is a fellow of the Royal Society and the Royal Academy of Engineering. He became a Commander of the British Empire in the 2007 New Years Honours list. In addition he has been awarded the top American, European and Japanese prizes in photonics. Recent awards include the Marconi Prize in 2008 and the 2007 IEE Photonics Award the first to be awarded to a person outside the USA. Most recently, in 2010, David received the ALLU (Association of Laser Users) Award for his pioneering work with fibre lasers.



Extreme Optics with Zero Refractive Index

09:00–09:45

Eric Mazur

Harvard Univ., USA

Biography: Eric Mazur is the Balkanski Professor of Physics and Applied Physics and Dean of Applied Physics at Harvard University, Member of the Faculty of Education at the Harvard Graduate School of Education, and President of the Optical Society. Mazur is a prominent physicist known for his contributions in nanophotonics, an internationally recognized educational innovator, and a sought after speaker. In education he is widely known for his work on Peer Instruction, an interactive teaching method aimed at engaging students in the classroom and beyond. In 2014 Mazur became the inaugural recipient of the Minerva Prize for Advancements in Higher Education. He has received many awards for his work in physics and in education and has founded several successful companies. Mazur is Chief Academic Advisor for Turning Technologies, a company developing interactive response systems for the education market. Mazur has widely published in peer-reviewed journals and holds numerous patents. He has also written extensively on education and is the author of *Peer Instruction: A User's Manual* (Prentice Hall, 1997), a book that explains how to teach large lecture classes interactively, and of the *Principles and Practice of Physics*

(Pearson, 2015), a book that presents a groundbreaking new approach to teaching introductory calculus-based physics. Mazur is a leading speaker on optics and on education. His motivational lectures on interactive teaching, educational technology, and assessment have inspired people around the world to change their approach to teaching.



VCSEL Arrays for 3D Sensing and Imaging

09:45–10:30

Connie Chang-Hasnain

Univ. of California, Berkeley, USA

Biography: Connie Chang-Hasnain is Associate Dean for Strategic Alliances of College of Engineering and Whinnery

Distinguished Chair Professor in Electrical Engineering and Computer Sciences, at the University of California, Berkeley. She has been the Founding Co-Director of Tsinghua-Berkeley Shenzhen Institute since 2015. She is also the Chief Academic Officer of Berkeley Education Alliance for Research in Singapore (BEARS) and Proram Leader of BEARS' SinBeRISE (Singapore Berkeley Research Initiative on Sustainable Energy) program since April 2015. Prof. Chang-Hasnain received her Ph.D. from UC Berkeley in 1987. Prior to joining the Berkeley faculty, Dr. Chang-Hasnain was a member of the technical staff at Bellcore (1987–1992) and Assistant Professor of Electrical Engineering at Stanford University (1992–1995). Professor Chang-Hasnain has been honored with many awards including the UNESCO Medal For the Development of Nanoscience and Nanotechnologies (2015), IEEE David Sarnoff Award (2011), the OSA Nick Holonyak Jr. Award (2007), etc. Additionally, she has been awarded with a National Security Science and Engineering Faculty Fellowship by the US Department of Defense (2008), a Humboldt Research Award (2009), and a Guggenheim Fellowship (2009). She was a member of the USAF Scientific Advisory Board, the IEEE LEOS Board of Governors, OSA Board of Directors, and the Board on Assessment of NIST Programs, National Research Council. She was the Editor-in-Chief of *Journal of Lightwave Technology* 2007-2012.



Future Network Scaling and the Need for Massive Opto-Electronic Array Integration

10:45–11:30

Peter Winzer
Nokia Bell Laboratories, USA

Biography: Peter J. Winzer received his Ph.D. from the Vienna University of Technology, Austria, where he worked on space-borne lidar and laser communications for the European Space Agency. At Bell Labs since 2000, he has focused on many aspects of fiber-optic communications, including advanced optical modulation, multiplexing, and detection. He has contributed to several high-speed optical transmission records and field trials from 100 Gb/s to 1 Tb/s and has been globally promoting spatial multiplexing to overcome the optical networks capacity crunch. He has widely published and patented and is actively involved with the IEEE Photonics Society and the OSA, including service as Editor-in-Chief of the IEEE/OSA Journal of Lightwave Technology, Program Chair of ECOC 2009, and Program/General Chair of OFC 2015/17. Dr. Winzer is a Highly Cited Researcher, a Bell Labs Fellow, a Fellow of the IEEE and the OSA, and an elected member of the US National Academy of Engineering.



Ultimate Optical-Wireless Network Convergence: Vision, Architecture and Real-Life Deployments

11:30–12:15

Dimitra Simeonidou
Univ. of Bristol, UK

Biography: Dimitra is a Full Professor at the University of Bristol, the Director of the Smart Internet Lab (www.bristol.ac.uk/smart), the Chief Scientific Officer (CSO) of Bristol Is Open and the Head of the High Performance Networks group (HPN), a Royal Society Wolfson scholar. Since 2015, Dimitra has been the technical architect and the CSO of the smart city project Bristol Is Open (www.bristolisopen.com), delivering the world's first open and programmable experimental test-bed at city-scale.

Her research is focusing in the fields of High Performance Networks, Software Defined Networking, Network Convergence and Smart City infrastructures. She is the author and co-author of over 400 publications, numerous patents and several major contributions to standards. She worked in Alcatel Submarine Networks as a Principle Engineer and she has been co-founder of two spin-out companies. The latest company is the University of Bristol, venture capital funded, spin-out Zeetta Networks (<http://www.zeetta.com>), delivering SDN solutions for enterprise networks. Since 2015, Dimitra has been the technical architect and the CSO of the smart city project Bristol Is Open (www.bristolisopen.com), delivering the world's first open and programmable experimental test-bed at city-scale.

Keynote Banquet Talk

Time: 18:30–21:30, Sunday, 12 November
Venue: Garden Grand Ballroom, The Garden Hotel



Nonlinear terahertz spectroscopy: Driving electrons, ions, dipoles, and spins

18:45–19:15

Keith Nelson
Massachusetts Institute of Technology, USA

Biography: Keith Nelson received his Ph.D. in Physical Chemistry from Stanford University in 1981, and after a postdoctoral stint at UCLA he joined the faculty at MIT in 1982. He has worked on discovery of new light-matter interactions and their exploitation for spectroscopy and control of coherent acoustic waves, lattice and molecular vibrations, excitons, spins, and their admixtures with light. He has developed novel methods for study of solid-state chemical reactions, crystals near phase transitions, glass-forming liquids, electronic excited-state dynamics, thermal transport, and matter far from equilibrium. He has pioneered tabletop generation of strong terahertz-frequency fields and nonlinear terahertz spectroscopy.

OSA Best Student Paper Awards

ACP 2017 is pleased to announce that this year's Best Student Paper Awards on ACP will be sponsored by OSA:

Best Student Paper Awards, 4 recipients, 3000 RMB (Chinese Yuan) for each

To be eligible for the award, a student must be the first author of the paper and declare his/her student candidature during online submission; and the student must give the presentation at the conference by himself/herself. The selection will be made by the subcommittees during the conference. The awards will be presented at the conference banquet in the evening of Sunday, 12 November.

OEMT Best Paper Award

ACP 2017 is pleased to announce that this year's Best Paper Awards on ACP will be sponsored by OEMT:

2 recipients, 3000 RMB (Chinese Yuan) for each

The candidates will be nominated by the subcommittee chairs. The winners will be selected by the TPCC during the conference. The awards will be presented at the conference banquet in the evening of Sunday, 12 November.

OEMT Best Poster Award

ACP 2017 is pleased to announce that this year's Best Poster Awards on ACP will be sponsored by OEMT:

2 recipients, 3000 RMB (Chinese Yuan) for each

The selection will be based on the voting of conference delegates. The awards will be presented at the conference banquet in the evening of Sunday, 12 November.



Poster Session

Time: 10:30–12:30, Sunday, 12 November
Venue: Exhibition Area, 3F, The Garden Hotel

Almost 200 posters will be displayed during ACP 2017. The poster session is designed to provide an opportunity for selected papers to be presented in greater visual detail and facilitate vivid discussions with attendees. Authors will remain in the vicinity of the bulletin board for the duration of the session to answer questions.

Workshops and Forums

Transmission and Switching Techniques for Data Centers

Workshop Time: 09:00–12:30, Friday, 10 November
Venue: The Garden Hotel, Orchid Room

Organizers: Yikai Su, Shanghai Jiao Tong Univ., China and Zhaohui Li, Sun Yat-Sen Univ., China

Description: Data center traffic is growing rapidly at an yearly rate of ~25%. Photonic technologies for transmission and switching can provide solutions to deal with this fast growth with high capacity, compact footprint and low power consumption. Optical interconnects within and between the data centers are key technologies. High data rate and low cost are desired in designing and implementation of transmission systems. Modulation and multiplexing techniques will be discussed and explored. Furthermore, the back planes of the electronic switches seem to impose limitations on data transfer speed and interconnect density. Optical switching may be able to handle large traffic of coarse granularities if combined with electronic switches for fine granularities. At the device level, in addition to VESELs and other III-V components, silicon photonics has penetrated into data centers with PSM4 and WDM.

Speakers:

09:00–09:20 Jian Wu, Beijing Univ. of Post and Telecommunications, China

Topic: Scalable Optical Interconnect Network Based on Small World Topology for Data Centers

09:20–09:40 Xiaolu Song, Huawei Technologies, China

Topic: High-density Optical Interconnects

9:40–10:00 Tao Chu, Zhejiang Univ. China

Topic: Large scale Silicon Photonic Switches

10:00–10:20 Lin Yang, Institute of Semiconductor, CAS, China

Topic: Silicon Optical Modulators for Data Centers

10:20–10:40 Coffee Break

10:40–11:00 Xiangjun Xin, Beijing Univ. of Post and Telecommunications, China

Topic: Title to be Announced

11:00–11:20 Ciyuan Qiu, Shanghai Jiao Tong Univ. China

Topic: Optical Switching Based on Silicon Microrings with Wavelength Alignment

11:20–11:40 Bo Liu, Beijing Univ. of Post and Telecommunications, China

Topic: High speed optical transmission system based on probabilistic shaping and geometric shaping

International Workshop on Visible Light Communications at ACP 2017

Workshop Time: 09:00–12:30, Friday, 10 November
Venue: The Garden Hotel, Magnolia Room

Organizers: Gong-ru Lin, National Taiwan University, China; Nan Chi, Fudan University, China; and Lilin Liu, Sun Yat-Sen University, China

Description: With the increasingly scarce of wireless spectrum resources and the urgent demands of high speed, safe, environmentally friendly means of communication in nowadays, visible light communication emerges at a historic moment. In recent ten years, VLC technology has been developed rapidly. Governments worldwide have paid great attentions on it. By using a LED as the signal transmitter, VLC is expected to integrate communication functions on the existing lighting facilities, which can provide a new wireless communication access to make full usage of resources. VLC can be used for many applications and areas, such as indoor and outdoor information network, indoor positioning systems, and security network systems.

The goal of this workshop is to provide a technical forum to present the latest research in in VLC and exchange ideas in this emerging green post-radio frequency technology. We welcome contributions from both academic and industry covering a range of topics in VLC including but not limited to the following:

- Indoor and outdoor optical channel modeling and characterization
- Enabling technologies on the physical layer: new LED and detectors, advanced modulation methods, equalization and estimation, new signal processing algorithms, etc.
- Topology control, routing and VLC network architecture
- Integration of VLC with PLC, Ethernet, WiFi and Mobile Communication
- Versatile applications of VLC systems/networks: Optical Camera Communications, under water wireless communication, navigation and localization, application in vehicular communications, etc.

Speakers:

09:00–09:20 Gong-Ru Lin, Graduate Institute of Photonics and Optoelectronics, National Taiwan University, China

Topic: Advances in Laser Diode White Lighting and Free-Space Communications

09:20–09:40 Nan Chi, School of Information Science and Engineering, Fudan Univ., China

Topic: Key Components for High-speed Visible Light Communication

9:40–10:00 Hao-Chung Kuo, National Chiao-Tung Univ., China

Topic: Progress of Blue VCSELs and u-LED/LDs

10:00–10:20 Ming Jiang, School of Electronics and Information Technology, Sun Yat-Sen Univ., China

Topic: Space-Time-Multiplexed Multi-Image VLP System Exploiting Pseudo-Miller-Coding for Smart Phones

10:20–10:40 Jian Zhang, Information Engineering Univ., China

Topic: Under-seawater High Speed Wireless Optical Communication

10:40–11:00 Coffee Break

11:00–11:20 Changyuan Yu, *Dept. of Electronic and Information Engineering, The Hong Kong Polytechnic Univ., China*

Topic: Data Transmission with Dimming Control in Indoor Visible Light Communication System

11:20–11:40 Chao Shen, *KACST-KAUST-UCSB Solid-State Lighting Program & KACST Technology Innovation Center for Solid-State Lighting at KAUST, China*

Topic: Semipolar GaN Laser and SLD Enabling High-speed Visible Light Communications

11:40–12:00 Jing Xu, *Optical Communications Laboratory, Ocean College, Zhejiang Univ., China*

Topic: Underwater Wireless Optical Communication: Recent Development in Ocean College, Zhejiang University

12:00–12:20 Lilin Liu, *School of Electronics and Information Technology, Sun Yat-Sen Univ., China*

Topic: Novel Mid-power GaN-based Flip-Chip LED for Dual Illumination and High Speed VLC Communications

Joint Research Center of Photonics & Joint Centre of Advanced Photonics Research Combined Workshop 2017 (JORCEP Workshop)

Workshop Time: 09:00–18:00, Friday, 10 November

Venue: *The Garden Hotel, Dahlia Room*

Organizers: Erik Forsberg, *Zhejiang University, China*;

Lech Wosinski, *Royal Institute of Technology, Sweden*; Hon

Tsang, *Chinese University of Hong Kong, China*; Liu Liu, *South China Normal University, China*; and Sailing He, *Royal Institute of Technology, Sweden*; Zhejiang University, *China*; South China Normal University, *China*

Description: The Sino-Swedish Joint Research Center of Photonics (JORCEP) has since 2003 been an ever evolving research and educational collaboration between several Swedish and Chinese universities that annually organizes a multi-disciplinary workshop to promote its joint research. Continuing a new tradition since 2015, the workshop is also this year combined with the annual workshop of that of the Zhejiang University - Chinese University of Hong Kong Joint Centre of Advanced Photonics Research.

Speakers

09:00–09:20 Sailing He, *Royal Institute of Technology, Sweden*; *Zhejiang University, China*; *South China Normal University, China*

Topic: Recent Activity and Progress at COER

09:20–09:40 Lech Wosinski, *Royal Institute of Technology, Sweden*

Topic: 8 Years of JORCEP Cooperation Project on Silicon Nanophotonics and Plasmonics

09:40 -10:00 Daoxin Dai, *Zhejiang University, China*

Topic: Multimode Silicon Photonics

10:00–10:20 Zhenzhou Cheng, *University of Tokyo, Japan*

Topic: Mid-Infrared Germanium Photonic Integrated Circuits

10:20–10:40 Liu Liu, *South China Normal University, China*

Topic: VCSEL and Silicon Photonics Integrated Circuits

10:40–11:00 Coffee Break

11:00–11:20 Chi-Wai Chow, *National Chiao Tung University, China*

Topic: Physically Secure Communications Using Visible Light Communications

11:20–11:40 Hon Tsang, *Chinese University of Hong Kong, China*

Topic: Integrated Mid-infrared HgTe Quantum Dot Photodetector

11:40–12:00 Chester Shu and Caoran Huang, *Chinese University of Hong Kong, China*

Topic: Raman-enhanced Optical Phase Conjugator in WDM Coherent Transmission Systems

12:00–12:20 Yaojing Zhang, *Chinese University of Hong Kong, China*

Topic: Forward Stimulated Brillouin Scattering in Silicon Microring Resonators

12:20–13:30 Lunch

13:30–13:50 Lars Thylen, *Royal Institute of Technology, Sweden*

Topic: Routes to the Further Development of Integrated Nanophotonics and Possible Relations to Novel Compatible Electronics

13:50–14:10 Jiajia Chen, *Royal Institute of Technology, Sweden* and *South China Normal University, China*

Topic: Do Children Trust Robots?

14:10–14:30 Elena Vasileva, *Royal Institute of Technology, Sweden*

Topic: Polymer Photonics...Organic Photonics...Wood Photonics...What Next?

14:30–14:50 Qiuqiang Zhan, *South China Normal University, China*

Topic: Title to be Announced

14:50–15:10 Kezhang Shi, *Zhejiang University, China*

Topic: Enhanced Near-Field Thermal Radiation Based on Multilayer Graphene-hBN Heterostructures

15:30–15:50 Tea/Coffee Break

15:50–16:10 Guangyu Zhao, *South China Normal University, China*

Topic: Inelastic Hyperspectral Lidar for Aquatic Ecosystems Monitoring and Landscape Plant Scanning Test

16:10- 16:30 Chao Fei, *Zhejiang University, China*

Topic: High-speed Underwater Optical Communication

16:30–16:50 Xuezhi Hong, *South China Normal University, China*

Topic: Research on Nonlinear Equalization in Visible Light Communication Systems

Exploiting the Space Domain of Electromagnetic Waves: The Ongoing Frontiers Workshop

Jointly hosted by:

China 973 Project 2014CB340000

EU H2020 Project 'ROAM'

China 973 Project 2014CB340100

China NSFC Project 61490710

Part I: Structured Lights and Their Applications

Workshop Time: 09:00–12:30, Friday, 10 November

Venue: The Garden Hotel, Begonia Room

Part II: Space-division Multiplexing (SDM) Communication

Workshop Time: 14:00–18:10, Friday, 10 November

Venue: The Garden Hotel, Begonia Room

Organizers: Xinlun Cai, Sun Yat-sen University, China;
Xiaocong Yuan, Shenzhen University, China

Almost all the applications of electromagnetic waves are about the manipulation of their physical dimensions including frequency/wavelength, complex amplitude, time, polarization, and space. The space domain is considered the only known physical dimension left to exploit in newly emerging applications of electromagnetic waves. As the ongoing frontiers, exploiting the space domain of electromagnetic waves has fueled lots of interesting research fields. For instance, structured lights accessing the spatial amplitude/phase/polarization distributions of lightwaves have given rise to many developments in astronomy, manipulation, trapping, tweezer, microscopy, imaging, sensing, nonlinear interactions and quantum information processing. Very recently, space-division multiplexing (SDM) is known as the only long-term viable path for sustained capacity scalability in optical communication networks, from short-reach data center interconnects and optical access networks to long-haul transport systems.

This workshop will focus on the ongoing frontiers in exploiting the space domain of electromagnetic waves. Two parts (structured lights and their applications, SDM communications) will be covered. Topics of relevance include but are not limited to:

Part I: Structured Lights and Their Applications

- Physics and fundamental properties of structured lights
- Different kinds of structured lights (LG beams, HG beams, Bessel beams, OAM beams, vector beams, accelerating beams, etc.)
- Devices for structured light generation, manipulation and detection
- Structured light enabled applications (astronomy, manipulation, trapping, tweezer, microscopy, imaging, sensing, nonlinear interactions, quantum information processing, etc.)
- Structured electromagnetic waves and their applications (radio wave, microwave, terahertz wave, etc.)

Part II: Space-division Multiplexing (SDM) Communications

- Free-space and fiber-based SDM communications.
- Multi-core fiber (MCF), few-mode fiber (FMF), multi-mode fiber (MMF), ring-core fiber (RCF) and other specialty fibers and photonic integrated devices for SDM communications.
- Efficient (de)multiplexing and amplification techniques for SDM communications.
- Multiple-input multiple-output (MIMO) assisted SDM communications and MIMO free SDM communications.
- Optical switching, optical signal processing and various networking functions in SDM communications.
- Information capacity scalability and limits in SDM communications.

We sincerely welcome scientists, students and industry representatives of relevant interest to attend and join the workshop.

Speakers Part I: Structured Lights and Their Applications

09:00–09:20 Siddharth Ramachandran, Boston University, USA

Topic: OAM in Fibers: How They are Different from OAM in Free Space and Other Fiber Modes

09:20–09:40 Martin Lavery, University of Glasgow, UK
Topic: Title to be Announced

09:40–10:00 Cheng Wei Qiu, National University of Singapore, Singapore
Topic: High-capacity Vortex Metasurfaces

10:00–10:20 Jin Liu, Sun Yat-Sen University, China
Topic: Deterministic Generation of Single-photons with Orbital Angular Momentum

10:20–10:40 Guixin Li, Southern University of Science and Technology, China
Topic: Nonlinear Photonic Metasurfaces and Geometric Berry Phase

10:40–11:00 Coffee Break

11:00–11:20 Xianmin Jin, Shanghai Jiao Tong University, China
Topic: Title to be Announced

11:20–11:40 Xilin Wang, University of Science and Technology of China, China
Topic: Photonic Quantum Information Processing with Orbital Angular Momentum

11:40–12:00 Lixiang Chen, Xiamen University, China
Topic: LED-based Twisted Light's Superpositions for Color Image and Audio Transmission

12:00–12:20 Xinlun Cai, Sun Yat-Sen University, China
Topic: Silicon Photonic Optical Vortex Emitters

Speakers Part II: Space-division Multiplexing (SDM) Communications

14:00–14:20 Guifang Li, University of Central Florida, USA and Tianjin University, China
Topic: SDM Is Not Just for Capacity

14:20–14:40 Xiaocong Yuan, Shenzhen University, China
Topic: Singular Optical Beam and its Applications

15:40–15:00 Mirco Scaffardi, CNIT, Italy

Topic: The European Project ROAM "Revolutionizing Optical Fiber Transmission and Networking Using the Orbital Angular Momentum of Light": Motivations and Recent Outcomes

15:00–15:20 Nicolas Fontaine, Nokia Bell Labs, USA

Topic: High Capacity SDM Transmission

15:20–15:40 Yongmin Jung, University of Southampton, UK

Topic: Recent Progress in SDM Amplifiers and their Related SDM Components

15:40–16:00 Coffee Break

16:00–16:20 Haoshuo Chen, Nokia Bell Labs, USA

Topic: Title to be Announced

16:20–16:40 Jian Wang, Huazhong University of Science and Technology, China

Topic: Recent Advances in Fiber-based OAM Multiplexing Transmission and Amplification

16:40–17:00 Jie Liu, Sun Yat-sen University, China

Topic: Scalable Mode Division Multiplexing Using Orbital Angular Momentum Mode Groups in Ring Core Fibers

17:00–17:20 Ting Lei, Shenzhen University, China

Topic: Multiplexing Devices for Optical Communication Using Singular Beams

17:20–17:40 Antonio Mecozzi, University of L'Aquila, Italy

Topic: Propagation Effects in Multimode Fibers

17:40–18:00 Takemi Hasegawa, Sumitomo, Japan

Topic: Coupled-core MCF for Long-Haul SDM Transmission

Photon-phonon Interaction: Fundamental, Material and Applications

Workshop Time: 14:00–18:10, Friday, 10 November

Venue: The Garden Hotel, Orchi Room

Organizers: Zhaohui Li, Sun Yat-Sen University, China; Lilin Yi, Shanghai Jiao Tong University, China; Ming Li, Institute of Semiconductor, CAS, China; Yang Yue, Juniper Networks in USA

Photon-phonon interaction in highly confined nanoscale waveguides or microfiber through guided-wave stimulated Brillouin scattering (SBS) has recently emerged as an important area of research. Compared with the photon-phonon

interaction in long optical fiber, the enhanced Brillouin nonlinearities caused by the emergence of large radiation pressure-induced couplings provides a means of nonlinear signal processing with reduced footprint and power consumption, which has important applications ranging from microwave photonics to optical memory. On the other hand, Brillouin nonlinearity is harmful because it is the major factor limiting the power of a fiber device. By special design of waveguide, optical fiber or microfiber, the photon-phonon interaction can also be suppressed or even canceled, which is important for high power fiber laser design. This workshop will focus on the challenges and recent advances in the field of photon-phonon interactions, including the fundamentals, materials and applications. The topics include nanoscale waveguide and microfiber based photon-phonon interaction enhancement and suppression, new materials based SBS effect, SBS performance improvement and new applications.

Speakers

14:00–14:20 Yang Liu, Sydney University, Australia

Topic: Recent Progress in High-performance SBS-based Signal Processing and Fully Integrated Devices

14:20–14:40 Junqiang Sun, Huazhong University of Science and Technology, China

Topic: Stimulated Brillouin Scattering in Silicon-based Integrated Waveguides

14:40–15:00 Thibaut Sylvestre, Institut FEMTO-ST, Université Bourgogne Franche-Comte, France

Topic: Photon-phonon Interactions in Optical Microfibers and Nanofibers

15:00–15:20 Fei Xu, Nanjing University, China

Topic: Opto-mechanical Interaction of Optical Microfibers

15:20–15:40 Duk-yong Choi, Australian National University, Australia

Topic: Chalcogenide Planar Waveguides for High Stimulated Brillouin Scattering Gain

15:40–16:00 Coffee Break

16:00–16:20 Huan Wang, Wiley

Topic: Living in a Materials World

16:20–16:40 Thomas Schneider, TU Braunschweig, Germany

Topic: Noise-free Brillouin based Microwave Photonics Filters

16:40–18:00 Lilin Yi, Shanghai Jiao Tong University, China

Topic: Software-defined Microwave Photonics Filter Based on Stimulated Brillouin Scattering

Silicon Photonics Workshop

Workshop Time: 09:00–12:00, Friday, 10 November

Venue: The Garden Hotel, Bauhinia Room

Organizers: Chairpersons:

Zhiping Zhou, Beijing University, China

Juren Michel, MIT

Zhaohui Li, Sun Yat-Sen University, China

09:00–09:30 Ching-Fuh Lin, National Taiwan University, China

Topic: Ultra-broadband infrared detection based on silicon photonics and plasmonic resonance

09:30–10:00 Pavel Cheben, National Research Council, Canada

Topic: Subwavelength Engineered Metamaterial Silicon Photonic Devices

10:00–10:30 Frederic Gardes, University of Southampton, UK

Topic: Group IV compounds and tunable index silicon nitride for multiplatform integrated photonics

10:30–11:00 Coffee Break

11:00–11:30 Cun-Zheng Ning, Arizona State University, USA

Topic: Nanolasers from a Silicon Nanobeam Integrated with Monolayer Molybdenum Ditelluride

11:30–12:00 Xinlun Cai, Sun-Yat Sen University, China

Topic: Silicon Photonic Devices for Quantum Key Distribution

11:30–12:30 Daoxin Dai, Zhejiang University, China

Topic: Silicon-based on-chip hybrid (de)multiplexers

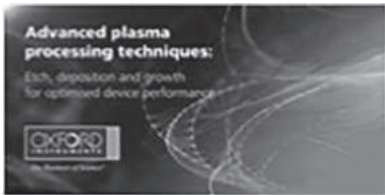
Advanced Plasma Processing Techniques: Etch, Deposition and Growth for Optimized Device Performance

Workshop Time: 14:00–17:35, Friday, 10 November

Venue: The Garden Hotel, Magnolia Room

Host: Oxford Instruments Plasma Technology

Chair: **Harm Knoops**, *Eindhoven University of Technology, Netherlands*



Plasma processing is an essential tool for making the latest optoelectronic devices. From dry etching of laser facets to high density passivation understanding how the

plasma can affect your device is vital to achieving the highest quality. Oxford Instruments Plasma Technology is at the forefront of plasma processing with a long history of developing innovative solutions to enable device performance to be pushed to the next level. This workshop will detail some of these latest developments with talks on plasma etching, Atomic Layer Deposition (ALD) and ICP CVD of dielectric films. Along side this users will detail their experiences and show how they have used our tools to deliver devices. Experts from the UK and local users will be here to share their knowledge in an open environment so please come along and enjoy the talks but also to ask any questions that you have.

A RSVP is required for this workshop. Visit the Workshops page on www.acpconf.org to register.

Speakers:

14:00–14:10 Welcome and Introduction

14:10–14:35 **Xin Zhang**, *Huawei, China*

Topic: Title to be Announced

14:35–15:00 **Lin Liu**, *Sun Yat-Sen University, China*

Topic: High Quality Plasma Deposition and Etching Processes for Photonic Materials and Devices

15:00–15:25 **Lin Zhang**, *Tianjin University*

Topic: Title to be Announced

15:25–15:50 **Ligang Deng**, *Oxford Instruments Plasma Technology*

Topic: Plasma Dry Etch Processes for III-V Materials Devices

15:50–16:20 Coffee Break

16:20–16:45 **Young Huang**, *Oxford Instruments Plasma Technology*

Topic: Low Damage Deposition by ICP CVD

16:45–17:10 **Harm Knoops**, *Oxford Instruments Plasma Technology*

Topic: Atomic Layer Deposition (ALD) for Optoelectronic Devices

17:10–17:35 **David Pearson**, *Oxford Instruments Plasma Technology*

Topic: Ion Beam Laser Bar Coatings

Industry Forum: Advances and Trends of Photonics Integration

Forum Time: 14:00–17:40, Friday, 10 November

Venue: The Garden Hotel, Bauhinia Room

Chair: **Yates Yao**, *President, Luster LightTech Group Corp, China*

Co-Chairs: **Jianhui Zhou**, *VP, Finisar Corporation, USA* and **Xiang Liu**, *Distinguished Scientist, Huawei Technologies, USA*

The industry forum of ACP is an excellent place where academics can learn the state of the art of the optical communications industry in terms of product, technology and market, and exchange ideas with experts from the industry.

This is the fourth time for Luster LightTech Group Corp to organize the ACP Industry forum. This year's industry forum will focus on photonics integration. Distinguished speakers from the industry will discuss the latest advances and trends of the photonic integration. The following topics will be covered in this forum:

- What are the key drivers for photonic integration in the industry?
- InP, silicon photonics, or hybrid, and why?
- What are the different roles photonic integration plays in long-haul, DCI, and intra-data center applications?

Speakers

14:00–14:20 **Tao Chu**, *Zhejiang University, China*

Topic: Electro-photonic Integration Technologies

14:20–14:40 **Saeid Aramideh**, *Ranovus, Canada*

Topic: Multi Terabit Data Center Networking Enabled by Quantum Photonics

14:40–15:00 **Akimasa Kaneko**, *NTT Lab, Japan*

Topic: Photonic Integration for Digital Coherent Optical Transmission

15:00–15:20 **John DeMott**, *Finisar, USA*

Topic: Integrated Indium Phosphide Optics for Next Generation High Baud Rate Coherent Transceivers

15:30–16:00 Coffee Break

16:00–16:20 **Zhiping Zhou**, *Peking University, China*

Topic: Why Silicon Photonics?

16:20–16:40 **Kansei Shindo**, *Fujikura Ltd, Japan*

Topic: Passive Optical Components for Silicon Photonic Integrated Devices

16:40–17:00 **Dong Pan**, *SiFotonics Technologies Co., Ltd., USA*

Topic: High Performance Ge/Si Devices and Silicon Photonics Integration for 100G/400G Communication

17:00–17:20 **Peter J. Winzer**, *Nokia Bell Laboratories, USA*

Topic: ON2020 – A Global Industry Effort on Long-term Perspectives in Innovative Optical Networking Solutions

17:20–17:40 **Panel Discussion**

Moderator: **Yates Yao, Jianhui Zhou, Xiang Liu**

Face to Face with the Editors: To do Better Research and to Write a Better Paper (in Chinese)

Forum Time: 19:30–21:30, Saturday, 11 November

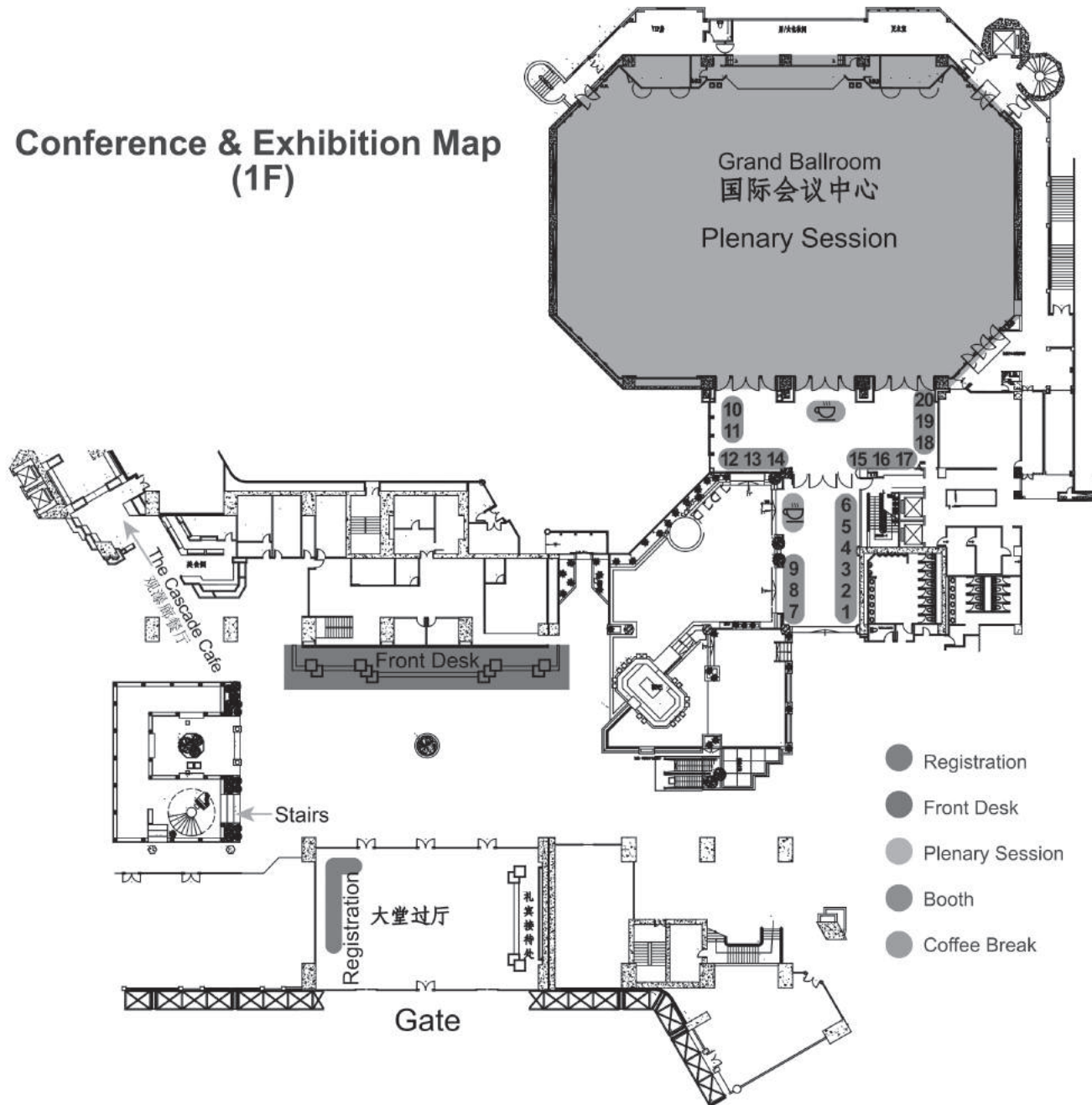
Venue: The Garden Hotel, Dahlia Room

Speakers:

Prof. Zhiping (James) Zhou, Editor-in-chief of *Photonic Research*

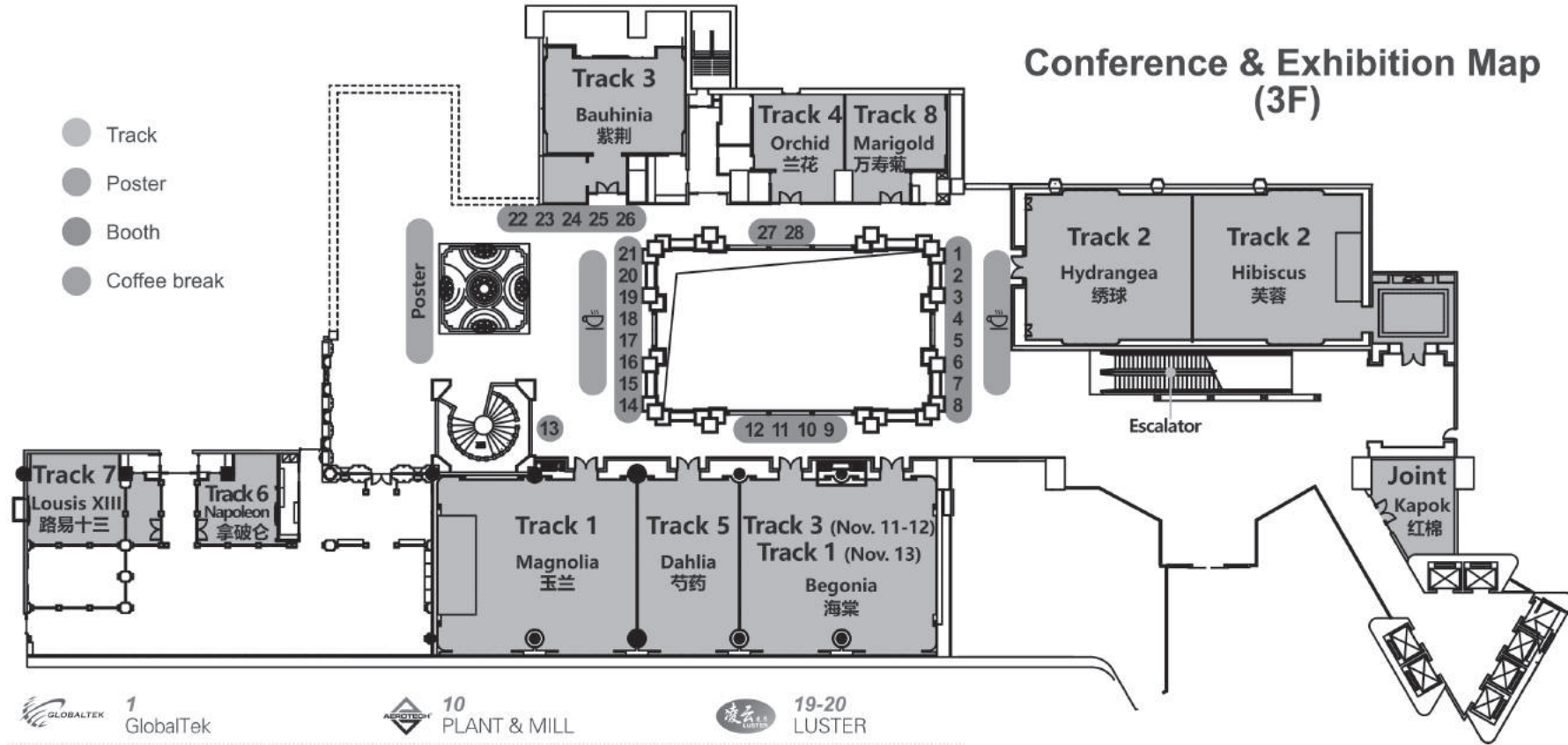
Dr. Xiaofeng Wang, Chief Editor of *Chinese Laser Press*

Conference & Exhibition Map (1F)



- | | | |
|--|----|---------------------------|
| | 1 | OESHOW |
| | 2 | Keysight |
| | 3 | santec |
| | 4 | OEMT |
| | 5 | COMTEST |
| | 6 | Epsilon Optoelectronic |
| | 7 | Newport |
| | 8 | Krug Scientific |
| | 9 | Amonics |
| | 10 | Thorlabs |
| | 11 | COHERENT |
| | 12 | GlobalTek |
| | 13 | RYMO PHOTONICS |
| | 14 | OXFORD INSTRUMENT |
| | 15 | LUSTER |
| | 16 | PlugTech |
| | 17 | Physik Instrumente (PI) |
| | 18 | A & P INSTRUMENT |
| | 19 | PLANT & MILL |

Conference & Exhibition Map (3F)

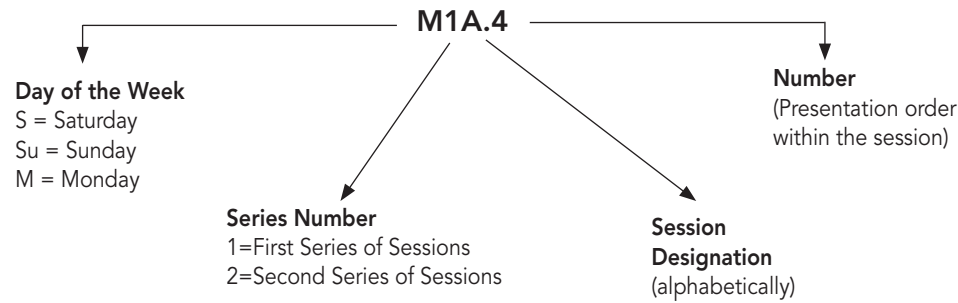


1 GlobalTek	10 PLANT & MILL	19-20 LUSTER
2-3 Miracle Photonics	11 CONQUER	21 OESHOW
4 Keysight	12 COMTEST	22 RYMO PHOTONICS
5 A & P INSTRUMENT	13 Epsilon Optoelectronic	23 PlugTech
6 Thorlabs	14 REAL PHOTON	24 Yangtze
7 OEMT	15 Chinese Laser Press	25 Physik Instrumente (PI)
8 Newport	16 COHERENT	26 santec
9 Krug Scientific	17-18 OXFORD INSTRUMENT	27 Amonics

- Track 1** | Optical Fibers and Fiber-based Devices
- Track 2** | Optical Transmission Systems and Networks
- Track 3** | Photonic Devices, Components, and Photonic Integration
- Track 4** | Microwave Photonics
- Track 5** | Micro-, Nano-, and Ultrafast Photonics
- Track 6** | Light emitting materials, devices, and Applications
- Track 7** | Photonics for Energy
- Track 8** | Photonics for Biology and Medicine

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Explanation of Session Codes



The first letter of the code designates the day of the week (S= Saturday, Su = Sunday, M=Monday). The second element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). The third element continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded M3C.4 indicates that this paper is being presented on Monday (M) in the third series of sessions (3), and is the third parallel session (C) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with **Invited**

Plenaries are noted with **Plenary**

Tutorials are noted with **Tutorial**

Asia Communications and Photonics Conference and Exhibition (ACP) — Agenda of Sessions

Friday, 10 November					
	Orchid Workshop	Magnolia Workshop	Dahlia Workshop	Begonia Workshop	Bauhinia Workshop
08:30–18:00	Registration, <i>Garden Hotel Lobby</i>				
09:00–12:30	Transmission and Switching Techniques for Data Centers Workshop	International Workshop on Visible Light Communications at ACP 2017	Joint Research Center of Photonics & Joint Centre of Advanced Photonics Research Combined Workshop 2017 (JORCEP Workshop)	Exploiting the Space Domain of Electromagnetic Waves: The Ongoing Frontiers Workshop Part I: Structured Lights and Their Applications	Silicon Photonics Workshop
10:30–11:00	Coffee Break, <i>Corridor 3F</i>				
12:30–14:00	Lunch Break				
14:00–18:00	Photon-phonon Interaction: Fundamental, Material and Applications	Advanced Plasma Processing Techniques: Etch, Deposition and Growth for Optimized Device Performance	Joint Research Center of Photonics & Joint Centre of Advanced Photonics Research Combined Workshop 2017 (JORCEP Workshop)	Exploiting the Space Domain of Electromagnetic Waves: The Ongoing Frontiers Workshop Part II: Space-division Multiplexing (SDM) Communications	Industry Forum: Advances and Trends of Photonics Integration
15:30–16:30	Coffee Break, <i>Corridor 3F</i>				

Asia Communications and Photonics Conference and Exhibition (ACP) — Agenda of Sessions

Saturday, 11 November											
	Magnolia Track 1	Hydrangea Track 2	Hibiscus Track 2	Begonia Track 3	Orchid Track 4	Dahlia Track 5	Napoleon Track 6	Louis XIII Track 7	Marigold Track 8	Bauhinia Track 3	Exhibition Area
08:00–18:00	Registration, <i>Garden Hotel Lobby (1F)</i>										Conference Exhibition
08:00–08:15	Opening Ceremony, <i>Garden Grand Ballroom (1F)</i>										
08:15–10:30	S1A • Plenary Session I, <i>Garden Grand Ballroom (1F)</i>										09:00–12:00 <i>outside Garden Grand Ballroom (1F)</i>
10:30–10:45	Coffee Break and Exhibition, <i>outside Garden Grand Ballroom (1F)</i>										
10:45–11:30	S2A • Plenary Session II, <i>Garden Grand Ballroom (1F)</i>										
12:15–13:30	Lunch Break										
13:30–15:30	S3A • SDM Fiber and Device Technologies I <small>(ends at 15:00)</small>	S3B • High Capacity Systems I	S3C • Metro and Access Systems	S3D • Integrated Spectrometers and Polarisation Splitters	S3E • Radio Over Fiber Technology	S3F • Light-Matter Interaction <small>(ends at 15:15)</small>	S3G • QLED & LASER	S3H • Novel Nanosystems for Energy I	S3I • Advanced Optical Diagnostic Technologies I	S3J • Novel Photonic Materials and Devices	13:00–18:00 <i>Corridor and Public Area (3F)</i>
15:30–16:00	Coffee Break, Poster Preview, and Exhibition, <i>Corridor 3F</i>										
16:00–18:00	S4A • Optical Fiber Sensor, Device & Technology I <small>(ends at 17:45)</small>	S4B • Short Reach Systems I	S4C • Elastic and Backbone Networks	S4D • Waveguides and RF Photonics	S4E • Photonics for 5G I	S4F • Nonlinear and Ultrafast Optics <small>(ends at 17:45)</small>	S4G • Novel Theory & Measurement	S4H • Novel Nanosystems for Energy II	S4I • Advanced Optical Diagnostic Technologies II	S4J • Optical Switching and Nonlinear Waveguide Devices	
18:30–21:30	Welcome Reception, <i>The Grand Ballroom, 1F, The Garden Hotel</i>										

Asia Communications and Photonics Conference and Exhibition (ACP) — Agenda of Sessions

Sunday, 12 November												
	Magnolia Track 1	Hydrangea Track 2	Hibiscus Track 2	Begonia Track 3	Orchid Track 4	Dahlia Track 5	Napoleon Track 6	Louis XIII Track 7	Marigold Track 8	Bauhinia Track 3	Kapok Joint	Exhibition Area
08:00–18:00	Registration, <i>Garden Hotel Lobby (1F)</i>											Conference Exhibition 09:00–18:00 <i>Corridor & Public Area (3F)</i>
08:30–10:30	Su1A • Advanced Fiber and Fiber Devices I	Su1B • Long Haul Systems	Su1C • Secured Communication	Su1D • Sub-wavelength Structured Devices	Su1E • Photonic Processing of Microwave Signal	Su1F • Waveguide and Fiber Optics (ends at 10:15)	Su1G • Technology and Application of LED (ends at 10:00)	Su1H • Perovskite PV	Su1I • Advanced Optical Diagnostic Technologies III	Su1K • III-V Integration	Su1L • Best Student Paper Competition I	
10:30–12:30	Su2A • Poster Session, Coffee Break, and Exhibition, <i>Exhibition Area</i>											
10:30–11:40	Postdeadline Sessions, <i>Bauhinian and Dahlia Rooms</i>											
12:30–14:00	Lunch Break											
14:00–16:00	Su3A • SDM Fiber and Device Technologies II	Su3B • Coherent Algorithm	Su3C • Access and SDM Networks	Su3D • Silicon Photonics i	Su3E • Integrated Microwave Photonics	Su3F • Metasurface and Metamaterial I (ends at 15:45)	Su3G • OLED & Optical Communication	Su3H • Novel PV	Su3I • Super-resolution Optical Imaging Technologies	Su3K • Mode Division Multiplexing and Orbital Angular Momentum Devices	Su3L • Best Student Paper Competition II	
16:00–16:30	Coffee Break & Exhibition, <i>Corridor 3F and Exhibition Area</i>											
16:30–18:00	Su4A • Transmission Fiber Systems and Nonlinearity Mitigation (ends at 18:15)	Su4B • High Capacity Systems II	Su4C • OFDM	Su4D • Photonic Integration and Optical Interconnects	Su4E • Photonics for 5G II	Su4F • Metasurface and Metamaterial II (ends at 17:45)	Su4G • Organic Electroluminescent Materials and Devices (ends at 17:45)	Su4H • Water Splitting	Su4I • Advanced Optical Diagnostic Technologies IV	Su4K • Photo-detectors		
18:30–21:30	Banquet & Adwards Ceremony, <i>Garden Grand Ballroom (1F)</i>											

Asia Communications and Photonics Conference and Exhibition (ACP) — Agenda of Sessions

Monday, 13 November

	Magnolia Track 1	Hydrangea Track 2	Hibiscus Track 2	Begonia Track 3	Orchid Track 4	Dahlia Track 5	Napoleon Track 2	Louis XIII Track 2	Marigold Track 8	Bauhinia Track 1	Exhibition Area
08:00–16:00	Registration, <i>Garden Hotel Lobby (1F)</i>										Conference Exhibition 09:00–16:00 <i>Corridor & Public Area (3F)</i>
08:30–10:30	M1A • High Power fiber Laser & New Amplifier Technologies I (ends at 10:15)	M1B • Space Division Multiplexing	M1C • Data Center Networks	M1D • Active III-V Devices	M1E • Microwave Photonics Based Signal Generation	M1F • Photonic Crystals (ends at 10:15)	M1G • Visible Light Communications	M1H • Performance Monitoring	M1I • Advanced Optical Diagnostic Technologies V	M1J • SDM Fiber and Device Technologies III	
10:30–11:00	Coffee Break and Exhibition, <i>Corridor 3F and Exhibition Area</i>										
11:00–12:30	M2A • Optical Fiber Sensor, Device & Technology II (ends at 12:15)	M2B • Short Reach Systems II	M2C • Transmission Techniques I	M2D • Silicon Photonics II	M2E • Application in Radar Field	M2F • Micro/Nanophotonics I (ends at 12:15)	M2G • Short Reach Systems III	M2H • New Transmission and Networking Techniques	M2I • Nano Biophotonics for Imaging and Therapy	M2J • Advanced Fiber and Fiber Devices II	
12:30–14:00	Lunch Break										
14:00–16:00	M3A • Optical Fiber Sensor, Device & Technology III	M3B • Fiber-wireless Integration	M3C • Metro and Backbone Networks		M3D • Sensing, Measurement and Other Applications	M3E • Micro/Nanophotonics II	M3F • Optical Wireless Systems	M3G • Transmission Techniques II		M3H • High Power Fiber Laser & New Amplifier Technologies II	
15:30–16:00	Coffee Break and Exhibition, <i>Corridor 3F and Exhibition Area</i>										

ACP 2017 — Saturday, 11 November

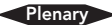
08:00–18:00 Registration, Garden Hotel Lobby (1F)

08:00–08:15 Opening Ceremony, Garden Grand Ballroom (1F)


Garden Grand Ballroom

08:15–10:30


S1A • Plenary Session I

S1A.1 • 08:15  Plenary

No Gain Without Payne, David N. Payne¹; ¹Univ. of Southampton, UK. Abstract not available.

S1A.2 • 09:00  Plenary

Extreme Optics with Zero Refractive Index, Eric Mazur¹; ¹Harvard Univ., USA. Nanotechnology has enabled the development of nanostructured composite materials (metamaterials) with exotic optical properties not found in nature. In the most extreme case, we can create materials which support light waves that propagate with infinite phase velocity, corresponding to a refractive index of zero. This zero index can only be achieved by simultaneously controlling the electric and magnetic resonances of the nano-structure. We present an in-plane metamaterial design consisting of silicon pillar arrays, embedded within a polymer matrix and sandwiched between gold layers. Using an integrated nano- scale prism constructed of the proposed material, we demonstrate unambiguously a refractive index of zero in the optical regime. This design serves as a novel on-chip platform to explore the exotic physics of zero-index metamaterials, with applications to super-coupling, integrated quantum optics, and phase matching.

S1A.3 • 09:45  Plenary

VCSEL Arrays for 3D Sensing and Imaging, Connie J. Chang-Hasnain¹; ¹Univ. of California Berkeley, USA. Vertical cavity surface emitting lasers (VCSELs) have long been predicted as low-cost enabling laser sources for many applications including optical communications, sensing and imaging. In this talk, I will discuss inventions and advances made in the last two decades and recently, all of which have led to recent wide deployment of commercial applications including LIDAR, 3D sensing and optical coherent tomography applications.

10:30–10:45 Coffee Break and Exhibition, Outside Garden Grand Ballroom (1F)

Garden Grand Ballroom

10:45–12:15

S2A • Plenary Session II

S2A.1 • 10:45  Plenary

Future Network Scaling and the Need For Massive Opto-Electronic Array Integration, Peter J. Winzer¹; ¹Nokia Bell Labs, USA. The evolution of network traffic and of associated communications technologies reveals clear long-term disparities, leaving no other option than introducing massively integrated parallelism to implement 10-Terabit/s transponders and Petabit/s systems well within 10 years.

S2A.2 • 11:30  Plenary

Ultimate Optical-Wireless Network Convergence: Vision, Architecture and Real-Life Deployments, Dimitra E. Simeonidou¹; ¹Univ. of Bristol, UK. This plenary will discuss key enablers for technology agnostic optical-wireless network convergence including: Open software and hardware solutions; Function programmable network infrastructures; Prototyping and system evaluation; Real life 5G urban deployments; Lessons learned and opportunities

12:15–13:30 Lunch Break

Magnolia, Track 1

13:30–15:00

S3A • SDM Fiber and Device Technologies I

President: Nicolas Fontaine; Nokia Corporation, USA

Hydrangea, Track 2

13:30–15:30

S3B • High Capacity Systems I

President: Alan Pak Tao Lau; Hong Kong Polytechnic Univ., China

Hibiscus, Track 2

13:30–15:30

S3C • Metro and Access Systems

President: Zhaohui Li; Sun Yat-Sen Univ., China

Begonia, Track 3

13:30–15:30

S3D • Integrated Spectrometers and Polarisation Splitters

President: Carlos Alonso-Ramos, Univ. Paris-Saclay

Orchid, Track 4

13:30–15:30

S3E • Radio over Fiber Technology

President: David Marpaung; Univ. of Sydney, Australia, Australia

S3A.1 • 13:30 Tutorial

Multimode Nonlinear Fiber Optics, Siddharth Ramachandran¹; ¹Boston Univ., USA. Fibers supporting multiple stable spatial modes enable intermodal nonlinear interactions yielding spatially coherent MW peak power pulses in colours not previously accessible from fiber sources. We review the physics and applications of this emerging platform.

S3B.1 • 13:30 Tutorial

Nonlinear Frequency Division Multiplexing: Fundamentals and Implementation in Lab, Henning Buelow¹, Vahid Aref¹, Son T. Le¹; ¹Nokia Bell Labs, Germany. In this tutorial the basics of nonlinear frequency division multiplexing (NFDMD) are revisited, modulation of all parts of the nonlinear spectrum is discussed and algorithmic and experimental elements for a successful implementation in lab are highlighted.

S3C.1 • 13:30 Tutorial

Optical Communications within 100 km Reach, Mathieu Chagnon¹; ¹Nokia Bell Labs - Stuttgart Univ., Germany. We overview direct-detect solutions for short reach Data Center Interconnects and mobile fronthaul up to 100 km. Advanced modulation formats, DSP schemes and complexity, and the emergence of semiconductor-based host photonic platforms are reviewed.

S3D.1 • 13:30

High-sensitivity optical sensor based on cascaded a FP Etalon and a ring resonator, Hui-Hui Zhu¹, Yong-Heng Yue¹, Ya-Jie Yue¹, Min Zhang¹, Jian-Jun He¹, Li MingYu¹; ¹Zhejiang Univ., China. The cascaded a FP Etalon and a ring resonator achieved a high sensitivity of 3554dB/RIU for intensity interrogation. The measurement power shows 8 dB increment comparing to that of the traditional cascaded double ring resonators.

S3E.1 • 13:30 Tutorial

Radio-over-Fiber Technology: Past and Present, Christina Lim¹, Ampalavanapillai Nirmalathas¹, Ka-Lun Lee¹, Chathurika Ranaweera¹, Elaine Wong¹, Yu Tian¹; ¹Univ. of Melbourne, Australia. Radio-over-fiber technology has been widely investigated and studied over three decades with much progress to date. This tutorial aims to provide an overview of the research trend over the last three decades and the achievements to date.

S3D.2 • 13:45

Integrated Refractive Index Sensing based on Racetrack Micro-Resonators with Higher-Order Modes, Ma Tao^{1,2}, Liu Heng¹, Yuan Jinhui^{3,4}, Fang Wang¹, Xu Wang¹, Jinhui Gao¹, Xiaohui Zhou², Zhe Kang¹, Feng Li⁴, Binbin Yan³, Xinzhu Sang³, Kuiru Wang³, Chongxiu Yu³; ¹College of Electronic and Electrical Engineering, Henan Normal Univ., China; ²College of Physics and Materials Science, Henan Normal Univ., China; ³State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications (BUPT), China; ⁴Photonics Research Center, Dept. of Electronic and Information Engineering, The Hong Kong Polytechnic Univ., China. We propose and investigate several integrated racetrack micro-resonators for refractive index sensing. The simulation results show that sensing performances are improved by using high order modes, meanwhile the metal nanostructures are also enhance the sensitivity.

Dahlia, Track 5

13:30–15:15
S3F • Light-Matter Interaction
Presider: Martin Booth; Univ. of Oxford, UK

S3F.1 • 13:30 **Invited**
Title to be Announced, Michael G. Somekh¹;
¹Hong Kong Polytechnic Univ., China. Abstract not available.

Napoleon, Track 6

13:30–15:30
S3G • QLED & LASER
Presider: Dragomir Neshev, The Australian National Univ., Australia

S3G.1 • 13:30 **Invited**
Efficient Quantum Dot Light-Emitting Diodes, Shuming Chen¹; ¹South U. of Sci. and Tech. of China, China. We will review our recent progress on QLEDs, particularly emphasizing the influence of device structures on the performance of QLEDs. Various device structures including top-emitting, microcavity, inverted, tandem, transparent, full-solution vacuum-free processed QLEDs will be talked.

Louis XIII, Track 7

13:30–15:30
S3H • Novel Nanosystems for Energy I
Presider: Michael Naughton; Boston College, USA

S3H.1 • 13:30 **Invited**
Symmetry Broken Nanostructures: Anisotropic and Multi-component Nanoparticles, Thomas Kempa¹; ¹John Hopkins Univ, USA. Low-dimensional and nanostructured materials with precisely tunable architectures/compositions are needed to advance our understanding of materials nucleation and growth and to enable discovery of new properties vital to scientific and technological advances. Anisotropic or multi-component nanostructures are a promising material type and are sought after, because their broken symmetries engender unique optical, catalytic, and mechanical properties. Nevertheless, methods to synthesize such symmetry broken nanostructures are in short supply. We demonstrate a one-pot, high-yield synthesis of structurally anisotropic nanoscale dimers composed of noble metals and propose a mechanism for their formation. Detailed electron microscopy studies, in conjunction with electrochemical, nuclear magnetic resonance, and optical spectroscopies, suggest these symmetry broken structures may possess unique catalytic and plasmonic properties. Through rational modifications to our synthetic strategy, we also access a range of unique material polymorphs and alloys.

Marigold, Track 8

13:30–15:30
S3I • Advanced Optical Diagnostic Technologies I
Presider: Walter Blondel; Universite de Lorraine, USA

S3I.1 • 13:30 **Invited**
Tissue Optical Clearing/Contrasting for Image Enhancement in the Ultra-Broad Wavelength Range, Valery V. Tuchin^{1,2}; ¹Saratov State Univ., Russian Federation; ²Tomsk State Univ., Russian Federation. The immersion optical clearing/contrasting technique will be presented. By using this technique different imaging modalities working in an ultra-broad wavelength range from x-ray to terahertz waves could be significantly improved. The controllable and reversible reduction of tissue scattering and/or absorption abilities is the basis of the method.

Bauhinia, Track 3

13:30–15:30
S3J • Novel Photonic Materials and Devices
Presider: Liu Liu; South China Normal Univ., China

S3J.1 • 13:30
Modulation of optical properties of BST/STO thin films in the terahertz range by 532nm and 1064nm continuous-wave laser, Ying Zeng¹, Songjie Shi¹, Furi Ling¹, Jianquan Yao²; ¹Huazhong Univ. of Science and Techn, China; ²Key Laboratory of Opto-electronics Information Technology, China. The modulations of refractive index and absorption properties of BST film (40.5nm)/STO film (41.2nm)/silicon substrate structure by 532nm and 1064nm continuous-wave laser pump were investigated in the terahertz range.

S3J.2 • 13:45
High Quality Factor Dry-etched Lithium Niobate Ridge Waveguide Micro-ring Resonators, Jian Jian¹, Hui Chen¹, Lin Liu¹, Lidan Zhou¹, Zeru Wu¹, Yujie Chen¹, Siyuan Yu^{1,2}; ¹Sun Yat-sen Univ., China; ²State Key Laboratory of Optoelectronics Materials and Technologies, China. We fabricated and characterized a high quality factor of 16,500 micro-ring resonator on Lithium Niobate thin film with a radius of 80 μm, using standard E-beam lithography and optimized Argon-based dry etch process.

Magnolia, Track 1

S3A.2 • 14:15 **Invited**

Fibre-based Components for SDM Systems, Yong-Min Jung¹, Saurabh Jain¹, Shaiful Alam¹, David Richardson¹; ¹*Optoelectronics Research Centre (ORC), UK*. We will review our recent research activities in SDM components and SDM amplifiers. Especially, recently developed fully integrated SDM optical isolators and SDM amplifiers will be discussed in more detail.

Hydrangea, Track 2

S3B.2 • 14:15

The Novel LMS Algorithm Free of Frequency/Phase Offset Feedback in Coherent Optic Receiver and Its Real Time Implementation, Tao Zeng¹, Jie Li¹, Liheng Meng¹, Liyan Huang²; ¹*Wuhan Res. Inst Post & Telecommunication, China*; ²*Accelink limited, China*. This paper proposes a novel LMS algorithm, which utilizes the characteristics that the two polarization signals are modulated and demodulated by the same transmitting/receiving optical sources, and eliminates the need of feedback-loop from the frequency/phase offset recovery stage.

Hibiscus, Track 2

S3C.2 • 14:15

40-Gb/s PAM4 Transmission Using Simplified Nonlinear Equalizations for Next-Generation Access Network, Xizi Tang¹, Ji Zhou¹, Mengqi Guo¹, Jia Qi¹, Fan Hu¹, Tiantian Zhang¹, Zhen-shan Zhang¹, Yueming Lu², Yaojun Qiao¹; ¹*State Key Laboratory of Information Photonics and Optical Communications, School of Information and Communication Engineering, Beijing Univ. of Posts and Telecommunications, China*; ²*Key Laboratory of Trustworthy Distributed Computing and Service, Ministry of Education, School of Cyberspace Security, Beijing Univ. of Posts and Telecommunications, China*. We experimentally demonstrate a 40-Gb/s PAM4 downstream transmission over 25 km fiber using simplified nonlinear equalizations. Up to 34 dB power budget can be achieved with a pre-amplified EDFA at the receiver.

Begonia, Track 3

S3D.3 • 14:00 **Invited**

On-chip Raman Spectroscopy Enabled by Silicon Photonics, Roel G. F. Baets^{1,2}, Stephane Clemmen^{1,2}, Nicolas Le Thomas^{1,2}, Frederic Peyskens^{1,2}, Haolan Zhao^{1,2}, Pieter Wuytens^{1,2}, Ali Raza^{1,2}, Xiaomin Nie^{1,2}, Nina Turk^{1,2}, Eva Ryckeboer²; ¹*Photonics Research Group, Ghent Univ. - imec, Belgium*; ²*Center for Nano- and Biophotonics, Ghent Univ., Belgium*. Raman spectroscopy is a powerful label-free technique enabling molecular detection and identification. Most Raman spectroscopy systems are bulky and expensive. Here we report on our efforts towards a Raman spectroscopy system integrated on a chip through the use of silicon photonics technology.

Orchid, Track 4

S3E.2 • 14:15 **Invited**

Radio over fiber-based radio relay link for indoor and in-car applications towards 5G/IoT era, Atsushi Kanno¹, Naokatsu Yamamoto¹, Tetsuya Kawanishi^{2,1}; ¹*National Inst Information & Comm Tech, Japan*; ²*Waseda Univ., Japan*. Radio over single-mode, multimode, and plastic optical fiber links are demonstrated as a radio relay link for improvement of coverage areas. These techniques are capable for different deployment scenarios in several indoor conditions.

Dahlia, Track 5**S3F.2 • 14:00** **Invited**

Waveguides and Hyperbolic Materials, H. P. Urbach¹; ¹*Technische Universiteit Delft, Netherlands*. Hyperbolic metamaterials are anisotropic materials of which the product of the eigenvalues of the permittivity matrix is negative. They have interesting properties such as that all extra-ordinary polarized plane waves are propagating, i.e. for this polarization there are no evanescent waves. I will discuss some interesting consequences for waveguides that are made of these materials.

Napoleon, Track 6**S3G.2 • 14:00** **Invited**

Full Color QLEDs Display Fabricated by Ink-jet Printing Technique, Junbiao Peng¹; ¹*South China Univ. of Technology, China*. This presentation will discuss full color QLEDs display fabricated by ink-jet printing techniques.

Louis XIII, Track 7**S3H.2 • 14:00** **Invited**

Manipulation of the Properties of Molecular Materials Based on Small Push-pull System, Jean Roncali¹; ¹*Moltech Anjou UMR 6200, CNRS, Univ. of Angers, France*. The effects of various modifications of the molecular structure of a small push-pull reference compound on the self-organization, hole-mobility, photovoltaic efficiency, mechano-fluoro-NLO-chromism and stability of the resulting materials are discussed.

Marigold, Track 8**S3I.2 • 14:00** **Invited**

Quantitative Characterization of Carcinoma Tissues at Different Progression Stages by Mueller Matrix Microscopy, Hui Ma¹; ¹*Tsinghua Univ., China*. We use Mueller matrix imaging and transformation to analyze quantitatively the diagnostic features of human breast carcinoma tissues in different stages, which demonstrate the potential power of Mueller matrix microscopy for clinical diagnosis of cancers.

Bauhinia, Track 3**S3J.3 • 14:00**

Efficient excitation of silicon photonic cavity modes from carbon nanotube photoluminescence, Weiwei Zhang¹, Elena Durán-Valdeiglesias¹, Samuel Serna¹, Niccolò Caselli², Francesco Biccari², Carlos Alonso-Ramos¹, Xavier Le Roux¹, Arianna Filoramo³, Massimo Gurioli², Laurent Vivien¹, Eric Cassan¹; ¹*Centre de Nanosciences et de Nanotechnologies, CNRS, Univ. Paris-Sud, Université Paris-Saclay, C2N – Orsay, France*; ²*Dept. of Physics, Univ. of Florence, European Laboratory for Non-linear Spectroscopy, Italy*; ³*CEA Saclay, IRAMIS, NIMBE (UMR 3685), LICSEN, France*. We report here the integration of a large quantity of s-SWCNTs as an active cladding layer on top of silicon micro/nano cavities. The gathered results show that the luminescence of the SCNTs can be efficiently coupled into the considered photonic crystal cavity modes.

S3J.4 • 14:15

Performance Improvement of Lithium Niobate High Extinction Ratio Modulators by Means of Photorefractive Trimming, Alexander Tronev^{2,1}, Mikhail Parfenov^{3,1}, Peter Agruzov¹, Igor Ilichev¹, Alexander Shamray^{1,3}; ¹*Ioffe Inst., Russian Federation*; ²*ITMO Univ., Russian Federation*; ³*Peter the Great Saint-Petersburg Polytechnic Univ., Russian Federation*. A local micro-size change of refractive index due to photorefractive effect was effectively used for the extinction ratio improvement of a Mach-Zehnder lithium niobate modulator. The extinction ratio increase of 17 dB was demonstrated.

Magnolia, Track 1

S3A.3 • 14:45

Generation of Multiple-Order OAM modes using a tilted Few-mode Fiber Bragg Grating, Yunhe Zhao^{1,2}, Changle Wang², Zuyao Liu¹, Kaiming Zhou², Chengbo Mou¹, Yunqi Liu¹, Lin Zhang², Tingyun Wang¹; ¹Shanghai Univ., China; ²Aston Univ., UK. We experimentally demonstrated the generation of the multiple-order orbital angular momentum modes (± 1 st, ± 2 nd and ± 3 rd order) using an UV-laser inscribed tilted few-mode fiber Bragg grating with mode conversion efficiency of $> 90\%$.

Hydrangea, Track 2

S3B.3 • 14:30

4x128Gb/s Faster-than-Nyquist 16-QAM WDM Transmission with Heterodyne Detection, Zeyu Chen¹, Yixiao Zhu¹, Xiaoke Ruan¹, Chenjia Li¹, Fan Zhang¹; ¹Peking Univ., China. We demonstrate 4x128Gb/s Faster-than-Nyquist 16-QAM WDM signal transmission with heterodyne detection using signal-signal beat interference cancellation. The overall BER achieves 2.7×10^{-3} ($< 7\%$ HD-FEC) after 80km SSMF transmission. The net spectral efficiency is as high as 4.04bit/s/Hz for one polarization.

S3B.4 • 14:45

First 400G system field tests on terrestrial multi-vendors G.654.E fibres, Shikui Shen¹, Guangquan Wang¹, Shuo Wang¹, Chunxu Zhao¹, Chenfang Zhang¹; ¹China Unicom, China. World first 400G terrestrial transport systems field tests on multi-vendors G.654.E fibres trials in China Unicom were demonstrated. Evaluation results verified G.654.E fibre with larger effective areas and lower attenuation could upgrade transmission capability greatly.

S3B.5 • 15:00

Transmission of 200G PM-16QAM Subcarriers with Reduction of Penalty from Linear Crosstalk Using Super-Nyquist Filtering and Low Complexity MMSE, Masaki Sato¹, Hidemi Noguchi¹, Emmanuel Le Taillandier de Gabory¹, Junichiro Matsui¹, Junichi Abe¹; ¹NEC Corporation, Japan. We improved the tolerance to linear crosstalk of 34GHz-spaced 272Gb/s PM-16QAM subcarriers by 0.5dB after 480km SSMF transmission, using Super-Nyquist Filtering and low complexity MMSE-based ISI compensation, compared to Nyquist shaping at identical circuit resource.

Hibiscus, Track 2

S3C.3 • 14:30

Dynamic Bandwidth Allocation in Multi-Carrier Access All-Optical Virtual Private Network using Microwave Photonic Filter, Chang-Hun Kim¹, Sun-Young Jung¹, Sang-Kook Han¹; ¹Yonsei Univ., Korea. We propose an all-optical virtual private network (VPN) using a tunable microwave photonic bandpass filter (MP-BPF) to support dynamic bandwidth allocation (DBA) between VPN and conventional up & down streams in an optical access networks.

S3C.4 • 14:45

A Multi-level Artificial Neural Network for Intra-band Nonlinear Compensations in Fiber-wireless Systems, Siming Liu^{1,2}, Weiheng Zhang¹, Mu Xu², Jing Wang², Huiping Tian¹, Gee-Kung Chang²; ¹Beijing Univ of Posts & Telecom, China; ²Georgia Inst. of Technology, USA. We propose a multi-level artificial neural network nonlinear equalizer for 16QAM transmissions in a 60-GHz millimeter-wave radio-over-fiber system. The intra-band nonlinear compression effect and nonlinear phase noise can be mitigated in the fiber-wireless systems.

S3C.5 • 15:00

Inter-Subcarrier Phase Scrambling for PAPR Reduction in IM-DD OFDM System, Xuebing Zhang¹, Ye Tian¹, Xiong Deng¹, Xinyang Lu¹, Zizheng Cao¹, A.M.J. Koonen¹; ¹Eindhoven Univ. of Technology, Netherlands. By breaking the strong phase connection of constellations among OFDM subcarriers, a pre-defined random phase sequence for PAPR reduction is applied in an IM-DD system. A ~ 0.8 dB receiving sensitivity improvement is achieved at 10^{-3} BER threshold.

Begonia, Track 3

S3D.4 • 14:30

Integrable Echelle Grating (De)multiplexer for 100GBASE-LR4, Yayan Chu¹, Lili Le¹, Yimin Xia¹, Pingli Huang¹, Jian-Jun He¹; ¹Zhejiang Univ., China. We experimentally demonstrate an echelle grating (de)multiplexer based on InGaAlAs/InP material using quantum-well intermixing technique. The device is suitable for monolithic photonic integration and can be applied to the 100GBASE-LR4 Ethernet system.

S3D.5 • 14:45

An asymmetrical SiN_x-based polarization beam splitter at 810 nm, Shisong Luo¹, Dongning Liu¹, Jiaquan Kong¹, Zengkai Shao¹, Zeru Wu¹, Pengfei Xu¹, Guoxuan Zhu¹, Yi Wang¹, Lin Liu¹, Yanfeng Zhang¹, Yujie Chen¹, Siyuan Yu^{1,2}; ¹Sun Yat-sen Univ., China; ²Univ. of Bristol, UK. An asymmetrical SiN_x-based polarization beam splitter at 810 nm are proposed and fabricated. Simulated results show that the extinction ratio of > 20 dB and the insertion loss of < 0.6 dB can be achieved for both TE and TM polarizations at 810 nm.

S3D.6 • 15:00

An O-band Silicon Polarization Splitter and Rotator Based on a Bi-level Taper and Cascaded MMI Couplers, Yingxuan Zhao^{1,2}, Chao Qiu^{1,3}, Aimin Wu^{1,3}, Zhen Sheng^{1,3}, Wei Li¹, Xi Wang¹, Shichang Zou¹, Fuwan Gan^{1,3}; ¹Shanghai Inst. of Microsystem and Information Technology, Chinese Academy of Sciences, China; ²Univ. of Chinese Academy of Science, China; ³Nantong Opto-Electronics Engineering Center Chinese Academy of Science, China. We present an O-band silicon PSR based on a bi-level mode-converter and cascaded MMI couplers. The device shows an insertion loss less than 0.5dB/0.65dB and crosstalk lower than -14dB/-13dB for TE/TM input polarizations respectively.

Orchid, Track 4

S3E.3 • 14:45

Microwave Photonic Down-Conversion System with Programmable Frequency Response Utilizing Optical Frequency Comb, Feiya Chen¹, Xiaoqi Zhu¹, Zhangyuan Chen¹; ¹Peking Univ., China. A novel microwave photonic down-conversion system with programmable frequency response utilizing optical frequency comb is demonstrated. Microwave signals between 25.5-40GHz are down-converted to 0.5-15GHz while the intermediate frequency filtering can be programmable.

S3E.4 • 15:00

High Order Single-side-band Signal Generation with Optical Carrier Suppression for Optical Frequency Comb, Wei Jiang^{1,2}, Shanghong Zhao², Qinggui Tan¹, Xiaojun Li¹, Dong Liang¹; ¹National Key Laboratory of Science and Technology on space Microwave, China; ²Air Force Engineering Univ., China. In this paper, we theoretically and numerically study a novel high order SSB-OCS signal generation based on Mach-Zehnders (MZMs). By properly adjusting a series of parameters of MZMs, such as modulation indexes and DC biases, a second order SSB-OCS signal with 28dB SMSR is generated, which can be further used in OFC generation.

Dahlia, Track 5

S3F.3 • 14:30

Huge light trapping with surface scattering structures in a flexible transparent substrate, Regis Barille¹; ¹Moltech Univ. of Angers, France. We show in this study the fabrication of quasi-random and Gaussian random structures (2D random structures) with a photo-induced nano-structured material for the control of light-matter interactions.

S3F.4 • 14:45

Manipulation of light-matter interaction in a disordered gold nanorod assembly for optical data storage, Yi Xu^{1,2}, Xu Ouyang², Ziwei Feng¹, Yaoyu Cao¹, Sheng Lan³, Cheng-wei Qiu⁴, Xiangping Li¹; ¹Inst. of Photonics Technology, China; ²College of Information Science and Technology, Dept. of Electronic Engineering, China; ³South China Normal Univ., School of Information and Optoelectronic Science and Engineering, China; ⁴National Univ. of Singapore, Dept. of Electrical and Computer Engineering, Singapore. We demonstrate the plasmonic coupling in a disordered gold nanorod assembly can be used to tailor the light-matter interaction in nanoscale, which resembles a versatile platform to realize multi-dimensional optical data storage beyond the state of the art.

S3F.5 • 15:00

Shaping of gold nanorods by light induced reduction and oxidation, Wanyi Li¹, Xiangping Li¹, yaoyu cao¹; ¹Jinan University, China. This article describes a novel approach for shaping gold nanorods by light induced reduction of gold ions and oxidation of gold nanorods, which enables optically tuning gold nanorods length from 0 to ~36 nm.

Napoleon, Track 6

S3G.3 • 14:30

Continuous-wave and passively Q-switched 1066 nm Nd:GYTO₄ laser, Zhenfang Peng¹, Yufei Ma¹, Ying He¹, Rengpeng Yan¹, Xudong Li¹, Xin Yu¹, Fang Peng³, Qingli Zhang³, Renqin Dou³, Jing Gao²; ¹Harbin Inst. of Technology, China; ²Suzhou Inst. of Biomedical Engineering and Technology, China; ³Anhui Inst. of Optics and Fine Mechanics, China. The continuous-wave (CW) and passively Q-switched 1066 nm laser performances with a novel Nd:Gd_{0.69}Y_{0.3}TaO₄ mixed crystal was demonstrated. The attained maximum peak power was 1.34 kW with the pulse repetition frequency of 74 kHz.

S3G.4 • 14:45

Oxide-Aperture-Diameter-Dependent RIN Analysis of Vertical-Cavity Surface-Emitting Lasers, Hui Li¹, Philip Wolf², James A. Lott³, Dieter Bimberg⁴; ¹Qingdao Univ. of Science & Technology, China; ²Technische Universität Berlin, Germany. Oxide-aperture-diameter-dependent RIN of VCSELs emitting at 980-nm has been systematically investigated. The results indicate that our VCSEL's energy efficiency is not in conflict with the RIN characteristics. Small oxide-aperture-diameter VCSELs, which are suitable for energy-efficient operation, also exhibit low laser RIN.

S3G.5 • 15:00

Linewidth and RIN measurement of a new single mode semiconductor laser, Dongtang Yang¹, Quanan Chen¹, su tan¹, Qiaoyin Lu¹, Weihua Guo¹; ¹HUST, China. In this paper, we present a detailed measurement of the spectral linewidth and RIN of a new single mode semiconductor laser. The laser with active section cavity length of 600 μm exhibits a minimum intrinsic linewidth of Voigt fitting around 760 kHz at 85 mA drive current and the minimum RIN is below -160 dB/Hz at room temperature.

Louis XIII, Track 7

S3H.3 • 14:30 **Invited**

Graphenel Polymers for Energy Storage Studies, Linjie Zhi¹, Long Hao¹; ¹National Center for Nanoscience & Tech., China. We demonstrate here a new class of materials termed as graphenel polymers for energy storage studies. Bottom-up strategies via defined chemical reactions provide an efficient way for the construction of carbon-rich frameworks with tunable structures and functions, which affords great opportunities to study in detail the relationship between chemical and physical structures and the electrochemical properties of the materials, particularly as electrode in supercapacitors.

S3H.4 • 15:00

Alcohol-Soluble Anode Modifier for Highly Efficient Inverted Solar Cells with Oligo-oxethylene Chains, Yue Jiang¹, Huojun Peng¹, Runsheng Mai¹, Jinwei Gao¹; ¹South China Normal Univ., China. Alcohol-Soluble small molecule DPA2T functionalized by oligo-oxethylene chains shows an effective p-p stacking in solid state. The implement of DPA2T in organic solar cells enhances the fill factor and the short circuit current resulting in a improvement of the overall power conversion efficiency. attributed to a better electron blocking effect.

Marigold, Track 8

S3I.3 • 14:30

Hyper-spectrum scanning laser optical tomography, Lingling Chen¹, Guiye Li¹, Yingchao Li¹, Lina Liu¹, Ang Liu¹, Shuangchen Ruan¹; ¹Shenzhen Univ., China. We present a quantitative fluorescence projection tomography technique which measures the three-dimensional fluorescence spectrum in biomedical samples with size up to several millimeters or even centimeter.

S3I.4 • 14:45

Air-holes Perforated Optical Waveguide Biosensor for Affinity Sensing, Ken Uchiyamada¹, Kiyoshi Asakawa¹, Hiroaki Suzuki¹; ¹Univ. of Tsukuba, Japan. An air-hole based waveguide (AHW) biochemical sensor, consists of periodical nano-cavity was developed. Simulation result proved the AHW sensor have 6.65 times higher sensitivity, compared to the multi-mode interferometer (MMI) sensor.

S3I.5 • 15:00

The energy transfer dynamics in C-phycoyanin hexamer by ultrafast time-resolved fluorescence spectroscopy, Mingyuan Xie¹, Xiaoxiao Wang², Wen-Jun Li², Song Qin², Fu-Li Zhao¹; ¹Sun Yat-sun Univ., China; ²Yantai Inst. of Coastal Zone Research, Chinese Academy of Sciences, China. The energy transfer dynamics by femtosecond time-resolved fluorescence spectroscopy in C-phycoyanin hexamer was studied. The energy transfer pathways in the hexamer were identified by deconvoluting the fluorescence decay curve at different detection wavelengths.

Bauhinia, Track 3

S3J.5 • 14:30

Visible light plasmonic-enhanced photocatalysis for highly efficient gas sensor, Yupeng Cheng¹, Mingyu Chen¹, Haiyan Wang², Jianlin Huang³, ChunLin Tan¹, Yuntao Zhu¹, Zongbao Li¹, Jianxin Yang¹, Xiaowen Hu¹, Debin Zhu¹, Xiaobo Xing¹; ¹South China Normal Univ., China; ²School of Information Technology, China; ³Guangzhou Inst. of Measuring and Testing Technology, China. A highly efficient gas sensor was developed based on photocatalysis heteronanostructures comprised of Au adsorbed on CdTe quantum-dot film (CdTe@Au) with alkalization treatment. The plasmonic-enhanced surface reactions lead to a valuable application for gas sensing.

S3J.6 • 14:45 **Invited**

ALD, ALE and 2D Materials: Atomic Scale Processing for Optoelectronics Applications, Harm Knoops^{2,1}; ¹Technische Universiteit Eindhoven, Netherlands; ²Oxford Instruments Plasma Technology, UK. Many applications are seeing a trend towards miniaturization and utilization of nanoscale effects. In this presentation atomic-scale processing techniques offered by Oxford Instruments will be discussed and possible benefits for optoelectronics applications are highlighted.

Magnolia, Track 1**Hydrangea, Track 2****Hibiscus, Track 2****Begonia, Track 3****Orchid, Track 4****S3B.6 • 15:15**

Improvement on Post-FEC BER Performance by Iterative Decoding Between a Feed-forward Carrier-Phase Estimator and an FEC Decoder, Shuai Yuan¹, Koji Igarashi¹; ¹*Osaka Univ., Japan*. We experimentally investigate the performance of iterative decoding between a trellis-based feed-forward carrier-phase estimator and an FEC decoder for DP-16QAM optical signals. The degradation of post-FEC BER performance due to residual phase noise is efficiently compensated.

S3C.6 • 15:15

Demonstration of 25 Gbit/s PAM4 Hybrid Photonic-Wireless Transmission, Roya Noorani¹, Lilin Yi¹, Peixuan Li¹, Weisheng Hu¹; ¹*Shanghai Jiao Tong Univ., China*. We experimentally demonstrate a hybrid optical fiber-wireless link by employing photonic heterodyning up-conversion on the existing PON with 10G class EML and 25Gbit/s PAM4 over 40km SMF. Off-line digital signal processing (DSP) is also employed for digital down conversion.

S3D.7 • 15:15

Polarization beam splitter based on strong anti-symmetric multimode Bragg gratings, Huiye Qiu¹, Liangjie Chen¹; ¹*Longyan Univ., China*. A broad bandwidth polarization beam splitter (PBS) based on strong coupling anti-symmetric multimode Bragg gratings on SOI platform is demonstrated. The measured bandwidth for 20-dB polarization isolation (PI) is over 64 nm.

S3E.5 • 15:15

Multi-service Radio Over Fiber System with Multiband Signal Generation Based on Polarization Multiplexing and Photonic Frequency Quadrupling Technique, Wenjing Xu¹, Xinlu Gao¹, Mingyang Zhao¹, Shanguo Huang¹; ¹*Beijing Univ. of Posts and Telecomm., China*. A simple cost-effective RoF system with baseband, microwave, millimeter-wave signal generation by using a single-drive MZM is experimentally demonstrated. The power penalties for bidirectional links are less than 0.5 dB after transmitted over 10.2-km SMF.

15:30–16:00 **Coffee Break, Poster Preview, and Exhibition, Corridor 3F**

Dahlia, Track 5**Napoleon, Track 6****Louis XIII, Track 7****Marigold, Track 8****Bauhinia, Track 3****S3G.6 • 15:15**

Single-mode lasing in bottle microresonators by spatial gain engineering, Fuxing Gu¹; ¹*Univ. of Shanghai for Science and Tech, China*. Based on engineering the pump intensity to modify the spatial gain profiles of bottle microresonators, we demonstrate a simple and general approach to realize single-whispering-gallery-mode (WGM) lasing in polymer bottle microresonators.

S3H.5 • 15:15

Guided Wrinkles Fabrication for Photovoltaics, Jianming Zhang¹, Chuanfei Guo¹; ¹*SUSTech, China*. Surface structures can increase internal light scattering. Here we present guided wrinkles fabrication used for photovoltaics to increase energy harvesting.

S3I.6 • 15:15

Preparation of ZnO Quantum Dots in a High-Gravity Rotating Packed Bed Reactor for Two-Photon Excited Fluorescence Imaging of Cells, Xianglei He¹, Dan Wang¹, Yuan Pu¹, Jianfeng Chen¹; ¹*State Key Laboratory of Organic-Inorganic Composites, Beijing Univ. of Chemical Technology, China*. ZnO quantum dots were prepared in a high-gravity rotating packed bed reactor and showed high fluorescence properties. Efficient in vitro cellular uptake of as-synthesized ZnO quantum dots was demonstrated by two-photon excited fluorescence imaging.

S3J.7 • 15:15

Spiral Holographic Imaging through Quantum Interference, Jie Tang¹, Yang Ming¹, Wei Hu¹, Yanqing Lu¹; ¹*National Laboratory of Solid State Microstructures, College of Engineering and Applied Sciences, Collaborative Innovation Center of Advanced Microstructures, Nanjing Univ., China*. Spiral holographic imaging based on the Hong-Ou-Mandel interference scheme is introduced. The first-order interference of light beams in standard holographic imaging is replaced by the quantum interference of two-photon probability amplitudes. The full information of the object can be recorded in the joint orbital angular momentum spectrum.

15:30–16:00 Coffee Break, Poster Preview, and Exhibition, Corridor 3F

Magnolia, Track 1

16:00–17:45
S4A • Optical Fiber Sensor, Device & Technology I
Presider: Xuping Zhang; Nanjing Univ., China

Hydrangea, Track 2

16:00–18:00
S4B • Short Reach Systems I
Presider: Kangping Zhong; MACOM, China

Hibiscus, Track 2

16:00–18:00
S4C • Elastic and Backbone Networks
Presider: Jiajia Chen; Kungliga Tekniska Hogskolan, Sweden

Begonia, Track 3

16:00–18:00
S4D • Waveguides and RF Photonics
Presider: Giampiero Contestabile; Scuola Superiore Sant Anna di Pisa, Italy

Orchid, Track 4

16:00–18:00
S4E • Photonics for 5G I
Presider: To be Determined

Saturday, 11 November

S4A.1 • 16:00 **Invited**
Advanced Specialty Optical Fibers for Sensor Applications, Jie Li¹; ¹OFS Fitel LLC, USA. Examples of specialty optical fibers used for sensing will be illustrated and special features of the fiber designs will be discussed along with the technical challenges unique to sensing applications.

S4B.1 • 16:00
Comparison of DMT and PAM-4 in Low-cost and Bandwidth-limited Optical Fiber Transmissions, Yang Song¹, Xinwen Yi¹, Jing Zhang¹, Xiatao Huang¹, Zengjie Zhang¹; ¹Univ. of Electronic Science and Technology of China, China. We compare both DMT and PAM-4 in low-cost and bandwidth-limited optical fiber transmissions. The performance difference depends on the interplay of the specific channel response and SNR.

S4B.2 • 16:15
98.7-Gb/s Optical SE-DMT Transmission Using an Enhanced Decision-Directed Algorithm with Preconditions, Changjian Guo^{1,2}, Baoxian Yu³, Langyu Yi¹, Yongsheng Xu¹, Xiong Wu³, Jie Liu³, Han Zhang¹; ¹South China Normal Univ., China; ²Dept. of Electric and Information Engineering, The Hong Kong Polytechnic Univ., China; ³School of Electrical and Information Engineering, Sun Yat-San Univ., China. We propose an enhanced decision-directed algorithm with preconditions for spectral efficient DMT signals. A 98.7-Gb/s 4-QAM modulated optical SE-DMT transmission over 2-km fiber is successfully demonstrated, achieving an electrical spectral efficiency of 3.9-bit/s/Hz.

S4C.1 • 16:00 **Invited**
Flexible Transceivers: Extracting More Capacity from Elastic Meshed Optical Networks, Xing-Yu Zhou^{2,1}, Qunbi Zhuge^{1,3}, Meng Xiang¹, Fangyuan Zhang¹, Baojian Wu², Kun Qiu², David V. Plant¹; ¹McGill Univ., Canada; ²Univ. of Electronic Science and Technology of China, China; ³Ciena Corporation, Canada. Flexible transceivers can maximize optical transmission capacity by adapting the flexibility features to dynamic link conditions. A higher degree of flexibility enables to extract more capacity from elastic meshed optical networks with cascaded ROADMs filtering.

S4D.1 • 16:00 **Invited**
Millimeter Wave Beam Steered Fiber Wireless Systems for 5G Indoor Coverage: Integrated Circuits and Systems, Zizheng Cao¹, Xuebing Zhang¹, Xinran zhao¹, Longfei Shen¹, Xiong Deng¹, Xin Yin², A.M.J. Koonen¹; ¹Eindhoven Univ. of Technology, Netherlands; ²Ghent University, Belgium. In this talk, we review our recent progress and on-going research on millimeter wave beam steered fiber wireless systems for 5G indoor coverage enabled by the advanced photonic integrated circuit and well-designed fiber-wireless networks.

S4E.1 • 16:00 **Invited**
Photonics for 5G in China, Junjie Li¹; ¹China Telecom Corp Ltd, Beijing Res Inst, China. Optical networking is the best solution to satisfy the high bandwidth and low latency requirements for 5G bearer. This presentation will introduce the requirements and technologies for optics for 5G fronthaul, middlehaul and backhaul.

Dahlia, Track 5

16:00–17:45

S4F • Nonlinear and Ultrafast Optics

President: Ya Cheng; East China Normal Univ., China

S4F.1 • 16:00 **Invited**

Dynamic Optics for Photonic Engineering, Martin J. Booth^{1,2}; ¹Univ. of Oxford, UK; ²Univ. of Erlangen Nuremberg, Germany. High-resolution optical fabrication is enhanced through dynamic optical elements, such as deformable mirrors or SLMs. Applications include manufacture of photonic devices, waveguides, colour centres in diamond, novel polymer/liquid crystal structures and diamond-based radiation detectors.

Napoleon, Track 6

16:00–18:00

S4G • Novel Theory & Measurement

President: Junbiao Peng; South China Univ. of Technology, China

S4G.1 • 16:00 **Invited**

Title to be Announced, Zhaojun Liu¹; ¹South Univ of Science & Tech of China, China. Abstract not available.

Louis XIII, Track 7

16:00–18:00

S4H • Novel Nanosystems for Energy II

President: Thomas Kempa; John Hopkins Univ, USA

S4H.1 • 16:00 **Invited**

From Small Lasers to Ultrathin Nonlinear Crystals, Xinfeng Liu¹; ¹National Center for Nanoscience and Technology, China. Small lasers are essential elements for the future integrated on-chip photonics, including lasers, sensors and high-volume data storage. In the first part, perovskite based small lasers (Fabry-Perot, WGM cavity) will be demonstrated. The advantages and disadvantages of perovskite serving as gain materials will be discussed. We also demonstrate the controlled growth of micro-laser array by using single layer BN as the buffer layer.

Marigold, Track 8

16:00–18:00

S4I • Advanced Optical Diagnostic Technologies II

President: Valery Tuchin; Saratov State Univ., Russian Federation

S4I.1 • 16:00 **Invited**

Multimodality fibered in vivo spectroscopy applied to skin hyperplastic and dysplastic class discrimination: spatially resolved data fusion-based classification, Walter Blondel^{1,2}, Faiza Abdat^{1,2}, Yann Guerneur^{3,4}, Marine Amouroux^{1,2}; ¹CRAN UMR 7039 UL-CNRS, Université de Lorraine, France; ²CRAN UMR 7039 UL-CNRS, CNRS, France; ³LORIA UMR 7503 UL-CNRS, Université de Lorraine, France; ⁴LORIA UMR 7503 UL-CNRS, CNRS, France. This contribution gives an overview on methods for exploiting the multimodal (diffusion, autofluorescence) and multiresolution (wavelength, spatial) dimensions of tissue spectroscopic data, focusing feature selection and multi-category classification strategies to improve skin precancerous stage discrimination.

Bauhinia, Track 3

16:00–18:00

S4J • Optical Switching and Nonlinear Waveguide Devices

President: Daoxin Dai; Zhejiang Univ., China

S4J.1 • 16:00 **Invited**

Photonic Integrated WDM Cross-connects for Disaggregated Optical Metro-Access Networks, Nicola Calabretta¹; ¹Technische Universiteit Eindhoven, Netherlands. We present a disaggregated optical metro node architecture that exploits lossless photonic WDM cross-connect switches based on semiconductor optical amplifiers for full flexible and high-capacity interconnecting network elements as well as computing and storage resources.

Magnolia, Track 1**S4A.2 • 16:30**

Distributed Fiber-optic Acoustic Sensor with Sub-nano Strain Resolution Based on Time-gated Digital OFDR, Dian Chen¹, Qingwen Liu¹, Zuyuan He¹; ¹Shanghai Jiao Tong Univ., China. Polarization and coherent fading problem in distributed fiber-optic acoustic sensor is well solved in this paper. The worst strain resolution along the whole 10-km sensing fiber approaches 245 pε and the spatial resolution is 5 m.

Hydrangea, Track 2**S4B.3 • 16:30**

Experimental Validation of Duobinary Modulation at 60 Gbaud for Data Center Interconnects of up to 300 km, Lau Suhr¹, Peter Madsen¹, Anders Clausen¹, Idelfonso Tafur Monroy¹; ¹Technical Univ. of Denmark, Denmark. This paper presents experimental results demonstrating a 60 Gbps duobinary signal, generated by a 25 GHz AWGe and transmitted over 320 km SSMF span employing EDFs and DCMs. The receiver is based on direct detection, lowpass filtering and equalization.

Hibiscus, Track 2**S4C.2 • 16:30**

Asymmetric Traffic Provisioning in Elastic Optical Networks Using Flexible Multiflow-Optical Transponder, Limei Peng¹, Geun-Soo Kim¹, Bingbing Li²; ¹Ajou Univ., Korea; ²Hubei Univ. of Technology, China. We propose an ILP model that provisions asymmetric traffic based on flexible multi-flow optical transponder (MF-OTP). Numerical results show that EONs using flexible MF-OTP can satisfy the asymmetric feature of traffic better.

Begonia, Track 3**S4D.2 • 16:30**

Transmission and reflection from a free carrier front in a silicon slow light waveguide, Mahmoud Gaafar^{1,2}, Dirk Jalas¹, Liam O'Faolain^{3,4}, Juntao Li⁵, Thomas F. Krauss⁶, Alexander Petrov^{1,7}, Manfred Eich^{1,8}; ¹Hamburg Univ. of Technology, Inst. of Optical and Electronic Materials, Germany; ²Dept. of Physics, Faculty of Science, Menoufia Univ., Egypt; ³SUPA, School of Physics and Astronomy, Univ. of St. Andrews, UK; ⁴Tyndall National Inst., Lee Maltings Comple, UK; ⁵State Key Laboratory of Optoelectronic Materials & Technology, Sun Yat-sen Univ., China; ⁶Dept. of Physics, Univ. of York, UK; ⁷ITMO Univ., Russian Federation; ⁸Inst. of Materials Research, Helmholtz-Zentrum Geesthacht, Germany. Optical transition with changes of frequency and wave vector can be induced by optically generated free carrier fronts that move along a slow light photonic crystal waveguide and interact with a co-propagating signal wave.

Orchid, Track 4**S4E.2 • 16:30** **Invited**

Long-reach Hybrid Digital/RF Radio-over-fiber at 30 GHz for 5G Applications, Stavros Iezekiel¹, Andreas Perentos¹, Georgios Charalambous¹, Roman Shmulevich², Shalva Ben-Ezra²; ¹Univ. of Cyprus, Cyprus; ²Opsys-Tech, Israel. We experimentally demonstrate a 60 km long radio-over-fiber link for transmission at 30 GHz with error-free transmission up to 1 Gb/s.

S4A.3 • 16:45

Experimental study on hybrid BOCDA/BOTDA sensors using noise-based phase modulation, Kai Lin¹, Xin-Hong Jia¹, Lei Ao¹; ¹School of Physics & Electronic Engineering, Sichuan Normal Univ., China. We experimentally demonstrated a distributed fiber sensor based on the hybrid Brillouin optical correlation-domain/time-domain analysis (BOCDA/BOTDA) employing noise-based phase modulation (PM). ~23.8 cm spatial-resolution along ~198 m polarization-maintaining fiber (PMF) was achieved.

S4B.4 • 16:45 **Invited**

Noncoherent Polarization-Multiplexing for TOSA/ROSA-Based 100G Optical Interconnect, Di Che¹, William Shieh¹; ¹Univ. of Melbourne, Australia. We proposed noncoherent polarization multiplexing (POL-MUX) recently without any coherence constraints (i.e. frequency or phase match) between the two polarizations. It enables an ultra-low-cost POL-MUX transceiver employing only direct modulation and direct detection.

S4C.3 • 16:45

Extending FIPP p-Cycles to Protect Straddling Paths for Dual Failure Network Protection, Yuxin Zhang¹, Ya Zhang¹, Gangxiang Shen¹; ¹Soochow Univ., China. We extend failure independent path-protecting (FIPP) p-cycles to support dual failure network protection. Results show that while guaranteeing a fast restoration speed, FIPP p-cycles can efficiently achieve spare capacity redundancy comparable to the conventional techniques.

S4D.3 • 16:45

Extrinsic losses in silicon slot photonic crystal waveguides: influence of the fabrication process, Samuel Serna¹, Xavier Le Roux¹, Weiwei Zhang¹, Carlos Alonso-Ramos¹, Delphine Marris-Morini¹, Laurent Vivien¹, Eric Cassan¹; ¹Centre de Nanosciences et de Nanotechnologies, CNRS, Univ. Paris-Sud, Université Paris-Saclay, France. We present in this work an experimental study of the influence of the e-beam and etching fabrication steps of photonic structures on the level of propagation losses in both the fast and slow wave propagation regimes.

Dahlia, Track 5S4F.2 • 16:30 **Invited**

Processing Quantum Information in Femtosecond-laser-written Integrated Photonic Circuits, Roberto Osellame¹; ¹*Inst. for Photonics and Nanotechnologies - CNR, Italy*. The use of integrated photonics in quantum optics produced dramatic improvements. Femtosecond-laser-written photonic circuits enables the manipulation of polarization-encoded single photons and the realization of 3D photonic circuits towards advanced quantum simulation and computation

Napoleon, Track 6S4G.2 • 16:30 **Invited**

Control of Light by 2D Materials Integrated with Resonant Photonic Nanostructures, Dragomir N. Neshev¹, Haitao Chen¹; ¹*The Australian National Univ., Australia*. We study the interactions between a monolayer transition-metal-dichalcogenide and photonic nanostructures to demonstrate enhanced directional photoluminescence or second-harmonic generation. Our approach represents a scalable platform for integration of 2D material with silicon photonics.

Louis XIII, Track 7S4H.2 • 16:30 **Invited**

Optical Processes in Nanostructures with Gain and Loss, Marek Trippenbach¹; ¹*Univ. of Warsaw, Poland*. Gain and loss are omnipotent in the physical, chemical and biological systems. Their effects can in a convenient way be modelled by effective non-Hermitian Hamiltonians. Imaginary contributions to the potential introduce source and drain terms for the probability amplitude. A special class of non-Hermitian Hamiltonians are those which possess a parity-time symmetry. In spite of their non-Hermiticity these Hamiltonians allow for real energy eigenvalues, i.e. the existence of stationary states in the presence of balanced gain and loss. This effect has been identified theoretically in a large number of quantum systems. Its existence has also been proved experimentally in coupled optical wave guides. In my talk I will provide concise review of these systems including the aspect of physics of energy conversion in nanostructures.

Marigold, Track 8S4I.2 • 16:30 **Invited**

Optical Clearing-based Intravital Imaging for Investigating Alternations of Subcutaneous Vascular and Monocytic Motility Function in Mice Model of Type 1 Diabetes, Dan Zhu¹; ¹*Huazhong Univ. of Science and Technology, China*. A Footpad skin optical clearing method was developed, and combined with various optical imaging techniques to access alternations of subcutaneous vascular and monocytic motility function with the development of mice type 1 diabetes mellitus.

Bauhinia, Track 3

S4J.2 • 16:30

Silicon optical switch elements based on coupled-ring resonators, Liangjun Lu¹, Lin Shen¹, Linjie Zhou¹, Jianping Chen¹; ¹*Shanghai Jiao Tong Univ., China*. We experimentally demonstrate two silicon optical switch elements based on coupled-ring resonators (CRR). The third-order CRR is switched by shifting the middle ring resonance, and the second-order CRR is switched by tuning the waveguide coupling.

S4J.3 • 16:45

Horseshoe-Shaped 16×16 Arrayed Waveguide Grating Router Based on SOI Platform, Yue Wu¹, Tingting Lang², Jian-Jun He¹; ¹*Zhejiang Univ., China*; ²*China Jiliang Univ., China*. We design and experimentally demonstrate a horseshoe-shaped 16×16 arrayed waveguide grating router with a channel spacing of 200 GHz based on SOI platform. The minimum insertion loss and the crosstalk are -3.5 dB and -16 dB, respectively.

Magnolia, Track 1

S4A.4 • 17:00
Support Vector Machine for Temperature Extraction from Brillouin Phase Spectrum, Huan Wu¹, Liang Wang¹, Nan Guo², Chester C.T. Shu¹, Chao Lu²; ¹*The Chinese Univ. of Hong Kong, China*; ²*The Hong Kong Polytechnic Univ., China*. We propose and demonstrate for the first time the use of Support Vector Machine (SVM) to extract temperature information from distributed Brillouin phase spectrum. The performance of SVM is evaluated under different experiment conditions.

Hydrangea, Track 2

S4C.4 • 17:00
Secure Virtual Optical Network Embedding over Optical Networks Integrated with Quantum Key Distribution, Yuan Cao¹, Yongli Zhao¹, Xiaosong Yu¹, Jie Zhang¹; ¹*Beijing Univ of Posts & Telecom, China*. Secure keys in optical networks integrated with quantum key distribution (QKD) are virtualized to construct secure VONs (SVONs). The QKD-integrated optical network virtualization architecture and SVON embedding algorithm are proposed.

Begonia, Track 3

S4D.4 • 17:00 **Invited**
Advanced photonic processing based on hybrid on-chip Brillouin photonic circuits, Benjamin J. Eggleton¹, Yang Liu¹; ¹*Univ. of Sydney, Australia*. We review the hybrid integration platform to generating large Brillouin gain on a silicon-based photonic chip, which allows for Brillouin amplifications and lasing, and promises a range of advanced functionalities including signal sources and signal processing.

Orchid, Track 4

S4E.3 • 17:00 **Invited**
THz Photonics for Future Smart Wireless, Xianbin Yu¹, Kexin Liu¹, Shiwei Wang¹, Shi Jia¹, Shilie Zheng¹, Xianmin Zhang¹; ¹*Zhejiang Univ., China*. This presentation reviews recent technological development of THz photonics based 100Gbit/s and beyond wireless communication systems, which is promising to enable ultrafast instant access of content-rich data stream in future application scenarios.

S4A.5 • 17:15
High Temperature and Strain sensitivities of a liquid crystal selective-filled high birefringent photonic crystal fiber based Sagnac Interferometer, Tingting Han¹, Yan-ge Liu², Zhi Wang²; ¹*Tianjin Normal Univ., China*; ²*Nankai Univ., China*. We investigated a liquid crystal selective-filled photonic crystal fiber by selectively infiltrating a liquid crystal into two adjacent air holes for sensing applications. The highest temperature and strain sensitivities are -41 nm/ °C and 24 pm/ με, respectively

S4B.5 • 17:15
Transmission Performance Improvement of PAM-4 Signal Direct-Detected by Ge-Si Photodiode using Volterra Equalization, Yung Hsu¹, C. Y. Chuang¹, Guan-Hong Chen¹, Yuan-Chia Chang¹, X Wu², L. Y. Wei¹, Chi Wai Chow¹, J. Chen¹, C. H. Yeh³, Hon K. Tsang²; ¹*National Chiao Tung Univ., China*; ²*Chinese Univ. of Hong Kong, China*; ³*Feng Chia Univ., China*. We demonstrate a 4-level pulse-amplitude-modulation (PAM-4) transmission system direct-detected by germanium-silicon (Ge-Si) photodiode (PD). Volterra-equalization is used to compensate signal distortion and 40-Gbit/s and 50-Gbit/s PAM-4 signals after 20-km and 10-km fiber transmissions are achieved.

S4C.5 • 17:15
Power Excursion Reduction in Flex-Grid Optical Networks with Symbol Rate Adaptation, Djamel Amar^{1,2}, Payman Samadi⁴, Keren Bergman⁴, Catherine Lepers², Mounia Lourdiane², Cedric Ware³, Philippe Gravey¹; ¹*IMT Atlantique, France*; ²*Telecom SudParis, France*; ³*Telecom ParisTech, France*; ⁴*Columbia Univ. in the City of New York, USA*. In this work, we propose a new use case of symbol rate adaptation in Flex-Grid optical networks. We demonstrate that symbol rate optimization of variable rate transponders can mitigate optical power excursion after spectrum defragmentation.

Dahlia, Track 5**S4F.3 • 17:00**

Laser-Direct Writing of Silver nanostructure on Transparent Substrates by femtosecond laser with high SERS, Yunxia Wang¹; ¹South China Normal Univ., China. We report a simple method for the laser direct writing of silver structures which are fabricated by using femtosecond laser (fs-laser) pulses on Transparent Substrates coating of Silver ion-doped Polyvinyl Pyrrolidone thin-film.

S4F.4 • 17:15

Femtosecond Laser Processing in New Mid-infrared Laser Crystals, Qiang Liu^{1,2}, Minming E. Geng^{1,2}, Yongze Yu³, Qiuqun Chen³, Zhenrong Zhang^{1,2}; ¹School of Computer, Electronics and Information, Guangxi Univ., China; ²Guangxi Key Laboratory of Multimedia Communications and Network Technology, Guangxi Univ., China; ³State Key Laboratory of Luminescent Materials and Devices, South China Univ. of Technology, China. For the first time, we explore femtosecond laser writing of waveguides in two new mid-infrared laser crystals. Guiding structures are demonstrated and possibilities for integrated mid-infrared waveguide lasers at 2.79 μm will be reported.

Napoleon, Track 6**S4G.3 • 17:00**

Injection Locking Method For Raman Beams In Atom Interferometer, Fei Zi¹, Jianing Deng¹, Daji Zeng¹, Tong Li¹, Mingli Sun¹, Xian Zhang¹, Kaikai Huang¹, Xuanhui Lu¹; ¹Dept. of Physics, Zhejiang Univ., China. Stimulated Raman transition is one of the decisive tools for coherent wave-packet manipulation in atom interferometer, which requires two phase coherent laser beams to couple the two hyperfine ground state levels.

S4G.4 • 17:15

Second harmonic measurement of multi-beam laser heterodyne for linear expansion coefficient of metal based on oscillating mirror sinusoidal modulation, Wang Shengqian¹, Zhong Weidan¹, Liu Yong¹, Li Yanchao¹; ¹HeiLongJiang Univ., China. This paper proposes a novel method of second harmonic measurement of multi-beam laser heterodyne for metal linear expansion coefficient, which is converted into the measurement of the length variation of linear expansion coefficient. Simulates measurement result shows that: the relative measurement error of this method is just 0.08%.

Louis XIII, Track 7**S4H.3 • 17:00** **Invited**

A 300-mm-wafer Silicon Photonics Technology for Ultra-low-energy Optical Network Systems., Koji Yamada¹, Tsuyoshi Horikawa¹, Makoto Okano¹, Guangwei Cong¹, Yuriko Maegami¹, Morifumi Ohno¹, Noritsugu Yamamoto¹, Keiji Suzuki¹, Ken Tanizawa^{1,2}, Satoshi Suda¹, Hiroyuki Matsuura¹, Keiji Koshino¹, Nobuyuki Yokoyama¹, Minoru Ohtsuka¹, Miyoshi Seki¹, Kazuyuki Matsumaro¹, Toshihiro Narushima¹, Kazuhiro Ikeda¹, Hitoshi Kawashima¹, Shu Namiki¹, Masahiko Mori¹; ¹AIST, Japan, Japan; ²Tamagawa Univ., Japan. A 300-mm-wafer silicon photonics with fine fabrication accuracy and uniformity provides large-scale photonic integrated circuits with low power consumption and operation flexibility, and provides us key photonic devices in an ultra-low-energy optical path network.

Marigold, Track 8**S4I.3 • 17:00**

Preliminary study investigating depth sensitivity of spatially resolved bimodal spectroscopy combined to optical clearing agents on a human skin based-hybrid model, Grégoire Khairallah^{1,3}, Marine Amouroux^{1,2}, Prisca Rakotomanga^{1,2}, Charles Soussen^{1,2}, Frédéric Marchal^{1,4}, Alain Delconte^{2,1}, Wei Feng^{5,6}, Dan Zhu^{5,6}, Walter Blondel^{1,2}; ¹CRAN UMR 7039 UL-CNRS, Université de Lorraine, France; ²CRAN UMR 7039 UL-CNRS, CNRS, France; ³Aesthetic Plastic and Reconstructive Surgery, Regional Hospital Metz-Thionville, France; ⁴Surgery Dept., Institut de Cancérologie de Lorraine, France; ⁵Collaborative Innovation Center for Biomedical Engineering, Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China; ⁶Britton Chance Center and MOE Key Laboratory for Biomedical Photonics, School of Engineering Sciences, Huazhong Univ. of Science and Technology, China. This preliminary study investigates depth sensitivity of spatially resolved-spectroscopy on skin subjected to a sucrose based-OCA. Skin transparency, reflected in estimated optical properties, significantly affects diffuse reflectance and fluorescence spectra collected at longest interfiber distances.

S4I.4 • 17:15

A Mathematical simulation of light transmission in multi-layered tissue during infrared neural stimulation, Xiaohu Liu¹, Yuwen Duan¹, Ru Zhang¹, Bo Zhou¹; ¹Beijing Univ. of Posts and Telecomm, China. A Monte Carlo model has been developed to simulate light transmission in tissue. The maximum temperature increase is 0.1°C, which effectively stimulate and won't hurt tissue when pulse energy is 25 $\mu\text{J}/\text{mm}^2$, wavelength is 0.185 μm .

Bauhinia, Track 3**S4J.4 • 17:00**

Experimental Characterization of the First Photonic Integrated Turbo-Switch Circuit, Tommaso Cassese¹, Nicola Andriolli¹, Claudio Porzi¹, Xuelin Yang², Giampiero Contestabile¹; ¹Scuola Superiore Sant'Anna, Italy; ²Shanghai Jiao Tong Univ., China. The first realization of an InP monolithically integrated SOA-based turbo-switch circuit is reported. The device includes a tunable laser, two SOAs and a delayed interferometer bandpass filter and has an overall footprint of 6 mm^2 .

S4J.5 • 17:15

Reconfigurable silicon optical filters using a dual-ring assisted Mach-Zehnder interferometer based 16x16 switch, Lin Shen¹, Zhanzhi Guo¹, Liangjun Lu¹, Linjie Zhou¹, Jianping Chen¹; ¹Shanghai Jiao Tong Univ., China. We demonstrate high-order silicon optical filters based on cascaded dual-ring assisted Mach-Zehnder interferometers in a 16x16 switch chip. The filter central wavelength and bandwidth are thermally tunable with the out-of-band rejection ratio >26 dB.

Magnolia, Track 1**S4A.6 • 17:30**

High sensitive bend sensor based on a fiber Bragg grating and ellipsoid structure, Sun Lei¹, Binbin Yan¹, Yuan Jinhui¹, Kuiru Wang¹, Xinzhu Sang¹, Yanhua Luo², Haifeng Qi³, Yunshu Gao⁴, Liwei Yang⁵, Xiao Chen⁴, Chang Wang³, Chongxiu Yu¹, Gangding Peng²; ¹Beijing Univ. of Posts. and Telecomm., China; ²Univ. of New South Wales, Australia; ³laser research Inst. of shandong academy of sciences, China; ⁴Minzu Univ., China; ⁵China Agricultural Univ., China. We demonstrate a bend sensor with a fiber Bragg grating (FBG) and ellipsoid structure. Cladding modes are excited by ellipsoid and recoupled back to the core mode by FBG. Bending curvature sensitivity is 19.78 mW/m¹.

Hydrangea, Track 2**S4B.6 • 17:30**

On the Performance of Increasing Subcarrier Order in Multi-Band Carrier-less Amplitude and Phase Modulation for Short Haul Optical Links, Paul A. Haigh¹, Jinlong Wei³, Tu Nguyen⁴; ¹Univ. College London, UK; ²Univ. of Bristol, UK; ³Huawei Technologies GmbH, Germany; ⁴Univ. de mons, Belgium. We show experimentally, for the first time, that an increasing subcarrier order in m-CAP optical-links does not result in proportional data-rate gain. We show that 10-CAP offers similar performance to 20-CAP with substantially less complexity.

S4B.7 • 17:45

Over 300-km Transmission of 25 Gb/s Optical SSB NPAM-4 Signal with Electronic Dispersion Pre-compensation and Interference Mitigation, Mingyue Zhu¹, Jing Zhang¹, Xinwen Yi¹, Ying Hao¹, Zengjie Zhang¹, Feng Wen^{1,2}, Longjiang Li³, Mian Zheng⁴, Kun Qiu¹; ¹Univ. of Electronic Science and Technology of China, China; ²Aston Univ., UK; ³Unit 78111 of Chinese People's Liberation Army, China; ⁴Southwest Petroleum Univ., China. We experimentally demonstrate the interference mitigation in direct-detection of optical SSB signals with Nyquist-PAM-4. At 25 Gb/s, we achieve over 300-km and 500-km SSMF with an average BER of 2.7×10^{-3} (<HD-FEC) and 9.4×10^{-3} (<SD-FEC), respectively.

Hibiscus, Track 2**S4C.6 • 17:30**

Fast-Reconfigurable Optical Interconnect Architecture Based on Time-Synchronized Node Coordination for High Performance Computing, Yufang Yu¹, Nan Hua¹, Zhizhen Zhong¹, Jialong Li¹, Ruijie Luo¹, Zelin Zheng¹, Xiaoping Zheng¹; ¹Tsinghua Univ., China. We propose a Fast-Reconfigurable Optical Interconnect (FROI) architecture enabled by time-synchronized node coordination for high performance computing. Experimental results show that an ultra-low reconfiguration time of 45.6 μ s can be achieved after traffic pattern changes.

S4C.7 • 17:45

Detouring in OCS with Edge Storage, Zonghuan V. Li¹; ¹Shanghai Jiao Tong Univ., China. This paper reveals that assistive storage at network may cause detour and hence may have an adverse impact on network performance. We propose two routing strategies to avoid such disadvantage and prove their effectiveness.

Begonia, Track 3**S4D.5 • 17:30** **Invited**

Integrated Optomechanical Devices and Their Applications, Lei Shi¹; ¹Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China. In this talk, I will introduce our recent work on integrated optomechanical devices using gradient force and their applications, including graphene-based optomechanical phase shifter, integrated optomechanical circuits for nonreciprocal propagation, all-optical tuning, and discrete photonics.

Orchid, Track 4**S4E.4 • 17:30**

Full Duplex Radio Over Fiber System Based on Polarization Multiplexing and Carrier Polarization-suppressed Double Sideband Modulation, Wenjing Xu¹, Xinlu Gao¹, Mingyang Zhao¹, Shanguo Huang¹; ¹Beijing Univ. of Posts and Telecomm, China. To avoid the bias-drifting problem of MZM and generate high frequency millimeter-wave signal simultaneously, we demonstrated a full-duplex RoF system using a phase modulator with 15 dB carrier suppression ratio via polarizers.

S4E.5 • 17:45

A Phase-Tunable Microwave Phonic Downconverter Based on Double-Sideband Modulation of Radio Frequency Signal and Local Oscillator Signal, Zheng M. Lei¹, Xinlu Gao¹, Mingyang Zhao¹, Shanguo Huang¹; ¹Beijing Univ. of Posts and Telecommunications, China. A phase-tunable microwave photonic downconverter based on microwave signals double-sideband modulation is proposed and simulated. A 16 GHz radio frequency signal is down converted to 6 GHz and 0°-360° phase shift is simultaneously realized.

18:30–21:30 Welcome Reception, The Grand Ball Room, IF, The Garden Hotel

Dahlia, Track 5

S4F.5 • 17:30

Nonlinear generation of non-paraxial accelerating beam, Guoliang Zheng¹, Shixiang Xu¹, Qingyang Wu¹, Jianmin Cao¹; ¹Shenzhen Univ., China. A non-paraxial accelerating beam (NAB) is generated through second harmonic generation. The nonlinear generation not only enables us to obtain a NAB at new wavelengths, but also presents an efficient way to control the NAB.

Napoleon, Track 6

S4G.5 • 17:30

Experimental investigation on the transverse relaxation time of cesium atoms, Yangying Fu¹; ¹College of Optoelectronic Science and Engineering, National Univ. of Defense Technology, China. We studied the effects of pump intensity, probe intensity, and pulse amplitude on the transverse relaxation time. Experimental results show paraffin coating offer narrower optical linewidth and larger optical rotation signal than buffer gas.

S4G.6 • 17:45

A method for measuring vapor densities of K and Rb simultaneously in SERF magnetometer, Kesheng Shen¹, Wei Quan¹, Yueyang Zhai¹, Xulin Wang¹, Zishan Fang¹, Xiaoli Zhang¹; ¹Beihang Univ., China. We propose a method for measuring vapour densities of K and Rb in a glass cell simultaneously at the working temperature of alkali-metal magnetometer, which based on their resonance lines and Raoult's Law.

Louis XIII, Track 7

S4H.4 • 17:30 **Invited**

Elucidating Nonlinear Processes in Light Harvesting Materials using 2-Beam Action Spectroscopies, John T. Fourkas¹; ¹Univ. of Maryland at College Park, USA. Nonlinear processes are of great importance in a wide range of technologies, including the conversion of solar energy to electricity. The quantification and analysis of these nonlinearities, as well as the identification of their origin (e.g., optical, chemical, or kinetic) is challenging using current optical methods. We have introduced a new class of methods to study the behavior of optical systems that exhibit nonlinear behavior. 2-beam action (2-BA) spectroscopies allow for the direct assessment of the nonlinearity contributing to a particular value of an experimental observable, such as emission intensity or photocurrent. I will discuss the application of two 2-BA spectroscopies, 2-beam constant emission intensity (2-BCEIn) spectroscopy and 2-beam constant photocurrent (2-BCoP) to gain new insights into photovoltaic processes.

Marigold, Track 8

S4I.5 • 17:30

Optical Ring Resonator Biosensor for Small Molecule Detection, Ziwei Cao¹, Jian-Jun He¹, Yirong Guo¹, Li MingYu¹; ¹Zhejiang Univ., China. We demonstrate a highly-sensitive SOI biosensor based on single ring with shallow etched grating coupler for detecting small molecule. To improve the sensitivity, the waveguide were designed for TM mode. The sensitivity is 0.061nm/ppm.

S4I.6 • 17:45

Dual SOAs based FDML swept source optical coherence tomography system, Shanshan Liang¹, Xinyu Li¹, Jun Zhang¹; ¹Sun Yat-sen Univ., China. A broad band Fourier domain mode-locked (FDML) swept source at center wavelength of 1310 nm was demonstrated. Dual SOAs were used to generate 180nm bandwidth swept range at 100 kHz sweeping rate.

Bauhinia, Track 3

S4J.6 • 17:30 **Invited**

An Ultra-efficient Nonlinear Integrated Platform for Optical Signal Processing and Generation, Minhao Pu¹, Luisa Ottaviano¹, Elizaveta Semenova¹, Francesco Da Ros¹, Hao Hu¹, Ayman N. Kamel¹, Yi Zheng¹, Erik Stassen¹, Michael Galili¹, Leif K. Oxenløwe¹, Kresten Yvind¹; ¹Technical Univ. of Denmark, Denmark. This paper will discuss the recently developed integrated platform: AlGaAs-on-insulator and its broad range of nonlinear applications. Recent demonstrations of broadband optical signal processing and efficient frequency comb generations in this platform will be reviewed.

18:30–21:30 **Welcome Reception, The Grand Ball Room, IF, The Garden Hotel**

Magnolia, Track 1

Hydrangea, Track 2

Hibiscus, Track 2

Begonia, Track 3

Orchid, Track 4

08:00–18:00 Registration, Garden Hotel Lobby (1F)

08:30–10:30

Su1A • Advanced Fiber and Fiber Devices I

President: Benyuan Zhu; OFS Laboratories, USA

08:30–10:30

Su1B • Long Haul Systems

President: Junho Cho; Nokia Bell Labs, USA

08:30–10:30

Su1C • Secured Communication

President: Lilin Yi; Shanghai Jiao Tong Univ., China

08:30–10:30

Su1D • Subwavelength Structured Devices

President: Hon Tsang; Chinese Univ. of Hong Kong, China

08:30–10:30

Su1E • Photonic Processing of Microwave Signal

President: Jose Capmany; Universidad Politecnica de Valencia, Spain

Su1A.1 • 08:30 **Invited**

Ultra Low Loss Fiber Technologies, Takemi Hasegawa¹; ¹Sumitomo Electric Industries Ltd, Japan. Ultra-low loss fibers, enabled by reduced Rayleigh scattering, benefit the submarine transmission by reducing the number of repeaters and improving the spectral efficiency. They are also applicable to capacity expansion by spatial division multiplexing.

Su1B.1 • 08:30

Impact of Symbol Rate Optimization on 6-bit/4D-Symbol Formats in Dispersion-Unmanaged Link, Tomofumi Oyama¹, Hisao Nakashima¹, Yohei Koganei¹, Yuichi Akiyama¹, Takeshi Hoshida¹; ¹Fujitsu Laboratories Ltd., Japan. We numerically investigate the impact of symbol rate optimization (SRO) on 6-bit/4D-symbol formats. Improvement of nonlinear tolerance by SRO is observed for uniformly-distributed QAM and PSK but not for a probabilistically-shaped QAM signal.

Su1B.2 • 08:45

106-Channel Transmission over a 1332 km-long Concatenated Unrepeated/ Repeated Link with real-time 150 Gb/s 8-QAM and 200 Gb/s 16-QAM, Sophie Etienne¹, Hans Bissessur¹, Sebastien Dupont¹, Pierre Marmier¹, Suwimol Dubost¹, Christian Bastide¹; ¹Alcatel Submarine Networks, France. We transmit 106 channels over a Raman-amplified 40 dB unrepeated link concatenated with a 1112 km long repeated line with EDFA amplification, and show 3.6 dB margin with 8-QAM and 1 dB margin with 16-QAM.

Su1C.1 • 08:30

Chaotic Radial Constellation Rotation for Physical-layer Security in OFDM-PON, Amber Sultan¹, Xuelin Yang¹, Syed Baqar Hussain¹, Weisheng Hu¹; ¹Shanghai Jiao Tong Univ., China. A secure physical-layer data encryption scheme is experimentally demonstrated using chaotic radial constellation rotation in OFDM-PON. An encrypted data transmission is successfully demonstrated for 9.4-Gb/s 16-QAM OFDM signals over 20 km fiber.

Su1C.2 • 08:45

Chaotic Encryption Algorithm for Resisting CPAs and Reducing PAPR in OFDM-PON, Xiaosong Fu¹, Meihua Bi^{1,2}, Guowei Yang¹, Yang Lu¹, Xuelin Yang², Shilin Xiao², Weisheng Hu²; ¹School of Communication Engineering, Hangzhou Dianzi Univ., China; ²State Key Laboratory of Advanced Optical Communication System and Networks, Dept. of Electronic Engineering, Shanghai Jiao Tong Univ., China. We demonstrate a chaotic encryption scheme for simultaneously resisting CPAs and reducing PAPR in OFDM-PON with cyclic XOR and an encrypted CAZAC matrix. Our scheme can achieve ~3-dB PAPR reduction and ~1-dB BER improvement.

Su1D.1 • 08:30 **Tutorial**

Subwavelength Grating Metamaterial Waveguides for Silicon Photonic Integrated Circuits, Pavel Cheben¹, Robert Halir³, Carlos Alonso-Ramos², Daniel Benedikovic²; ¹National Research Council Canada, Canada; ²CNRS, France; ³Univ. of Malaga, Spain. This tutorial will cover the principles, design, fabrication and applications of subwavelength metamaterial structures in integrated optics, including a comprehensive overview of recent advances in implementations of these structures in silicon photonics.

Su1E.1 • 08:30 **Tutorial**

On-chip Microwave Photonics, David Marpaung¹; ¹Univ. of Sydney, Australia. Incorporation of photonic integration in microwave signal processing is one of the fastest growing fields. This technology is expected to underpin ultra-high-speed wireless communications. Here we review the latest advancements in integrated microwave photonics.

Dahlia, Track 5

Napoleon, Track 6

Louis XIII, Track 7

Marigold, Track 8

Bauhinia, Track 3

Kapok, Joint

08:00–18:00 Registration, Garden Hotel Lobby (1F)

08:30–10:15

Su1F • Waveguide and Fiber Optics

President: Nanfang Yu; Columbia Univ., USA

08:30–10:00

Su1G • Technology and Application of LED

President: Zhaojun Liu; South Univ. of Science and Technology, China

08:30–10:30

Su1H • Perovskite PV

President: Jinwei Gao; South China Normal Univ., USA

08:30–10:30

Su1I • Advanced Optical Diagnostic Technologies III

President: Junle Qu; Shenzhen Univ., China

08:30–10:30

Su1K • III-V Integration

President: Liu Liu; South China Normal Univ., China

08:30–10:30

Su1L • Best Student Paper Competition I

Su1F.1 • 08:30 **Invited**

Integrated Photonics Breathing New Life into Multimode Optical Fibre Communications, Nicolas Riesen², Simon Gross¹, Michael J. Withford¹; ¹Macquarie Univ., Australia; ²Univ. of South Australia, Australia. Optical fibres based on multi-core and few mode formats are being developed to meet the growing demand for data. The development of compatible end-of-fibre components based on laser written 3D photonics will be reviewed.

Su1G.1 • 08:30 **Invited**

Impact of the n⁺-GaN/AlGaIn/p⁺-GaN Tunnel Junction on III-nitride UV Light-emitting Diodes, Luping Li¹, Yonghui Zhang¹, Zi Hui Zhang¹; ¹Hebei Univ. of Technology, China. This work conducts comprehensive analysis and presents in-depth understanding regarding the n⁺-GaN/AlGaIn/p⁺-GaN tunnel junction so that the hole injection, the current spreading effect and the internal quantum efficiency can be improved for III-nitride UV LEDs.

Su1H.1 • 08:30 **Invited**

Microstructural Characterisation of Hybrid Perovskite Solar Cells, Yi-Bing Cheng¹; ¹Monash Univ., Australia. Organic-inorganic hybrid perovskite solar cell is a new type of thin film photovoltaic technology and has achieved extraordinary improvements in power conversion efficiency in a relatively short time. One of the most important factors leading to the rapid advancement of perovskite solar cells is the ability to manipulate the microstructure of the perovskite layer and the adjacent functional layers within the device. Characterisation of microstructures of perovskite solar cells has been shown particularly challenging due to the fragile nature of the organic-inorganic perovskite compounds and the consequent potential for generating artefacts through the application of the characterization methods themselves. In this talk, we will report our studies on microstructures of perovskite solar cell materials using different characterisation techniques, highlighting the sensitivity of hybrid perovskite compounds under electron beams and presenting some characteristic microstructural features obtained in perovskite solar cell materials, such as twin domains in tetragonal CH₃NH₃PbI₃ thin films and ion segregation in mixed ion perovskites. These microstructural features have different effects on the properties of perovskite solar cells.

Su1I.1 • 08:30 **Tutorial**

Non-invasive Optical Imaging of Tissue Morphology and Microcirculations in vivo, Ruikang K. Wang¹; ¹Univ. of Washington, USA. This paper will show the OCT and OMAG's ability to visualize tissue blood flow at the microcirculation level in a variety of biomedical applications, including cerebral blood flow in small animal models, retinal vessel networks and subcutaneous skin microcirculation in humans.

Su1K.1 • 08:30 **Invited**

Recent Progress on III-V/Si Lasers, Zhechao Wang, Keysight, China. Being a viable solution to Si on-chip laser sources, integration of III-V lasers on silicon photonic integrated circuits (PIC) made tremendous progress in the past few years. In this talk, we will review our recent work on: monolithic integration of InP/InGaAs-based heterostructure lasers on silicon, monolithic integration of GaAs-based quantum-well (QW) lasers on silicon, and bonding-based heterogeneous integration of various laser configurations, such as low rep rate mode-locked lasers, on silicon.

Su1L.1 • 08:30

Secure Communication Using Anticorrelated Noise, Il-Pyeong Hwang¹, Chang-Hee Lee^{1,2}; ¹KAIST, Korea; ²Chongqing Univ. of Technology, China. We propose a novel secure optical communication method using an anticorrelated noise. We demonstrate the secure communication with a secure data rate of 2.05 Gb/s against an eavesdropper on a single path.

Su1L.2 • 08:45

Demonstration of a Visible Light Communication System Based on Filter Bank Spread OFDM/OQAM, Junwei Zhang¹, Changjian Guo¹, Liu Liu¹, Sailing He^{1,2}, Xuezhi Hong¹; ¹South China Academy of Advanced Optoelectronics, South China Normal Univ., China; ²Dept. of Electromagnetic Engineering, Royal Inst. of Technology (KTH), Sweden. We propose and experimentally demonstrate a 2.2Gbit/s visible light communication system based on filter bank spread (FBS-) OFDM/OQAM. Both low peak-to-average power ratio and high diversity gain are achieved by FBS, which improves transmission performance.

Magnolia, Track 1

Su1A.2 • 09:00 **Invited**

New Type Communication Optical Fibers in Chinese Terrestrial Network, Zhang Lei^{1,2}; ¹R&D Center, Yangtze Optical Fiber and Cable Joint Stock Limited Company, China; ²State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China. In this paper, we compared the differences and the advantages of ultra low loss and large effective area fiber in terrestrial network and also introduced the fibers' deployment and application in Chinese market.

Hydrangea, Track 2

Su1B.3 • 09:00

Coupled-Subcarrier Frequency and Polarization Coded Probabilistic Constellation for ROADM Systems, Takahiro Kodama¹, Masanori Hanawa¹; ¹Yamanashi Univ., Japan. A novel probabilistic-shaped 56 Gbaud DP-QPSK signal using coupled-subcarrier frequency and polarization coding was simultaneously mitigated fiber nonlinearity, optical filtering and PDL effects. We show 1 dB Q improvement for cascaded ROADM system.

Su1B.4 • 09:15 **Invited**

Flexible Bitrate Systems Basing on Pragmatic QAM, Hybrid Formats and Probabilistic Shaped Formats, Fred Buchali¹; ¹Nokia Bell Labs, Germany. We show that a combined symbol rate – spectral efficiency adaptation allows for highest flexible adaptation of reach, bitrate and spectral efficiency.

Hibiscus, Track 2

Su1C.3 • 09:00

Demonstration of 40 Gb/s secure optical communication system based on 40 Gchip/s SPE and symbol overlapping, Zhensen Gao², Bo Dai², Gerald Buller¹, Xu Wang¹; ¹Heriot-Watt Univ., UK; ²Univ. of Shanghai for Science and Technology, China. We demonstrate a 40Gb/s DPSK secure optical communication system using 40Gchip/s time stretched optical spectral phase encoding and symbol overlapping. Security robustness against eavesdropping attacks have been demonstrated for ultra-long optical codes with 128-, 512- and 1024-chip in the experiment.

Su1C.4 • 09:15

Security-Enhanced Chaos Communication Based on Cascaded Random Phase-Modulated Feedback, Guilan Li¹, Ning Jiang¹, Shuiqing Lin¹, Chao Wang¹, Chengpeng Xue¹, Kun Qiu¹; ¹Univ of Electronic Science & Tech China, China. We propose a security-enhanced communication scheme with time delay signature suppression and phase encryption, by using cascaded random phase modulation for the feedback. Moreover, the low frequency signature is well hidden in the frequency spectrum.

Su1C.5 • 09:30

1.6 Tb/s Random Number Generation Using a Spectrum Expanded Chaotic Signal, Anke Zhao¹, Ning Jiang¹, Chao Wang¹, Chengpeng Xue¹, Kun Qiu¹; ¹Univ of Electronic Science & Tech China, China. 1.6 Tb/s random bit generation is achieved by expanding the efficient-bandwidth of physical chaos up to 65 GHz and processing the samples with the technologies of subtraction, the bit-order reversal, and the exclusive-OR operation.

Begonia, Track 3

Su1D.2 • 09:15

Broadband and compact contradirectional coupler with subwavelength grating waveguides, Jun Zou¹, Dingshan Gao¹; ¹Huazhong Univ. of Science and Technology, China. We proposed a new broadband contradirectional coupler composed by subwavelength grating (SWG) waveguides on silicon-on-insulator wafer. The 3-dB bandwidth can reach up to 29 nm and the length of coupling region is only 50 μm .

Su1D.3 • 09:30

High-NA silicon nitride metalens for unpolarized visible light, Zhi-Bin Fan^{1,3}, Zeng-Kai Shao^{2,3}, Ming-Yuan Xie^{1,3}, Fu-Li Zhao^{1,3}, Yujie Chen^{2,3}, Si-Yuan Yu^{2,3}, Jian-Wen Dong^{1,3}; ¹School of Physics, Sun Yat-sen Univ., China; ²School of Electronics and Information Technology, Sun Yat-sen Univ., China; ³State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen Univ., China. We demonstrate a polarization-insensitive silicon nitride metalens that can be designed as large numerical aperture (~0.98) divergent lens with high transmission (~0.8) for visible light, and fabricated using 695 nm thick hexagonal silicon nitride array.

Orchid, Track 4

Su1E.2 • 09:15 **Invited**

Plasmonic Modulators for Microwave Photonics Applications, Maurizio Burla¹, Romain Bonjour¹, Yannick Salamin¹, Felix C. Abrecht¹, Christian Haffner¹, Wolfgang Heni¹, Claudia Hoessbacher¹, Benedikt Baeuerle¹, Arne Josten¹, Yuriy Fedoryshyn¹, Peter Johnston², Delwin Elder², Larry Dalton², Juerg Leuthold¹; ¹ETH Zurich, Switzerland; ²Dept. of Chemistry, Univ. of Washington, USA. We discuss the potential of ultrafast (>170 GHz) and ultra-compact (10s μm^2) plasmonic modulators on silicon for microwave photonics applications, with emphasis on mm-wave and sub-THz wireless communications and signal processing.

Su1A.3 • 09:30

High Precision Photonic Crystal Fiber Optic Gyroscope for Space Application, Xiaobin Xu¹, Ningfang Song¹, Zhihao Zhang¹, Wei Cai¹, Fuyu Gao¹; ¹Beihang Univ., China. A low-loss (~1.7dB/km) PM-PCF has been designed and fabricated, based on which a PCFOG having a bias stability of ~0.002°/h is developed. The PCFOG has a flight test in "Tianzhou-1" Cargo Spaceship.

Dahlia, Track 5

Su1F.2 • 09:00 **Invited**
Optofluidic Applications Using Droplet Resonators and Optical Fiber Resonators Coupled with Tapered Optical Fiber Waveguides, Alper Kiraz^{1,2}; ¹Dept. of Physics, Koç Univ., Turkey; ²Dept. of Electrical and Electronics Engineering, Koç Univ., Turkey. We achieved coupling to liquid droplet resonators with tapered optical fiber waveguides. Quality factors exceeding 1 million were observed. We also report bulk refractive index sensing using optical fiber resonators.

Su1F.3 • 09:30
Effects of Doublet Broadband Brillouin Absorption Resonances on Fast Light in Optical Fibers, Yuanyuan Ma¹, Shanglin Hou¹, Daobin Wang¹, Jingli Lei¹, Xiaoxiao Li¹; ¹Lanzhou Univ. of Technology, China. The effects of doublet broadband Brillouin absorption resonances on fast light in optical fibers are numerically investigated with fast Fourier transform (FFT) algorithm. Maximum advancement and less distortion of the signal pulse can be obtained by optimizing the frequency separation between two absorption resonances and the energy of pump laser.

Napoleon, Track 6

Su1G.2 • 09:00
Hollow Light Guide for Light Weight and High Efficiency Planar Illuminator, ZhiTing Ye¹, Yung Min Pai¹, Hao-Chung Kuo¹, Chen-Huan Chen¹; ¹National Chiao Tung Univ., China. A hollow light guide with a diffusive reflection cavity associated with edge-light LED light sources has been proposed to resolve the issues of weight, uniformity and efficiency simultaneously. The experiment shows an overall efficiency of 84.35%, uniformity of 90.5%

Su1G.3 • 09:15
A Novel Miniaturized Dielectric Optical Nanoantenna, Yue Xu¹, Tao Dong¹, Hang Zhao¹; ¹China Academy of Space Technology, China. A novel miniaturized dielectric optical nanoantenna operating at 1550 nm based on passive silicon-on-insulator (SOI) process is proposed. The realized gain reaches 13.5 dB and the side-lobes are suppressed.

Su1G.4 • 09:30
Micro cutting on Gallium Nitride LED Surface for Light Extraction Efficiency Enhancement, Dong Yuan¹, Xianyu Lin¹, Rui Zhou¹, Guofu Zhou^{1,2}, Nan Li²; ¹South China Normal Univ., China; ²Shenzhen Guohua Optoelectronics Tech. Co. Ltd., China. Light extraction microstructure manufactured by micro cutting was proposed. Micro cutting experimental system was built, the material deformation during cutting, influence of cutting depth and distance, phenomenon happened with two direction cross cutting were studied.

Louis XIII, Track 7

Su1H.2 • 09:00 **Invited**
High Transmittance Inorganic Semiconductors as a Hole-transport Window for Planar Inverted Perovskite Solar Cells, Zhubing He¹; ¹Southern Univ of Science & Technology, China. Besides of high transmittance for window, these hole-transport inorganic materials involved in the p-i-n device structure were modulated to fit the energy diagram of the whole device through doping or surface modifications. Systematical photo-physical characterization tools were used to analyze the effect of band-gap engineering.

Su1H.3 • 09:30 **Invited**
p-Type Layer Engineering of Hybrid Metal halide Perovskite Photovoltaics, Jacek J. Jasieniak¹; ¹Monash Univ., Australia. NiO and its doped forms have been the most widely used p-type layers in hybrid perovskite solar cells. Here we present a facile approach towards the growth of scaffolded NiO using chemical bath deposition, which is suitable for making hybrid perovskite solar cells with >16% efficiency and fill factors of up to 85%.

Marigold, Track 8

Su1I.2 • 09:15 **Invited**
Functional Fourier Domain Optical Coherence Tomography and its Applications, Zhihua Ding¹; ¹Zhejiang Univ., China. Typical applications of structural and functional OCT are presented. Novel OCT systems with enhanced performances and novel contrasts will definitely open new OCT applications.

Bauhinia, Track 3

Su1K.2 • 09:00 **Invited**
Hybrid III-V on SOI Nanolaser Diodes, Fabrice Raineri^{1,2}, Guillaume Crosnier¹, Dorian Sanchez¹, Sophie Bouchoule¹, Isabelle Sagnes¹, Rama Raj¹; ¹C2N-CNRS, France; ²Universite Paris Diderot, France. We demonstrate a novel class of compact and power efficient optoelectronic devices integrated on SOI photonic circuit based on InP photonic crystals nanocavities. In particular, results on electrically injected hybrid nanolasers will be shown.

Su1K.3 • 09:30
InGaAlAs electroabsorption-modulated DFB-laser having high extinction ratios fabricated by identical epitaxial layer technique, Qiufang Deng¹, Song Liang¹, Xiao Xie¹, Hongliang Zhu¹, Wei Wang¹; ¹Inst. of semiconductor, China. InGaAlAs electroabsorption-modulated DFB-lasers fabricated by identical epitaxial layer technique are demonstrated. The laser has larger than 20-dB static extinction ratios at -2V modulator reverse bias. The small signal modulation bandwidth is larger than 11 GHz.

Kapok, Joint

Su1L.3 • 09:00
Dynamic Bandwidth Slicing to Support Service Migration in Passive Optical Network Based Mobile backhaul, Jun Li¹, Lena Wosinska¹, Jiajia Chen¹; ¹KTH-Royal Inst. of Technology, Sweden. We propose partitioning large-size data generated by service migration and show that it can properly handle user mobility and fog computing in PON-based mobile backhaul, while latency and jitter of non-migrated traffic is significantly reduced.

Su1L.4 • 09:15
Caching Strategies for Storage-Shared Content Delivery Networks, Ning Wang¹, Gangxiang Shen¹, Sanjay K. Bose²; ¹Electronic and Information Engineering, Soochow Univ., China; ²Electrical and Electronic Engineering, Indian Inst. of Technology, India. We propose three different caching strategies and develop analytical models for each strategy in a storage-shared Content Delivery Network. Simulation results show renew caching lifetime on user's request can achieve the best performance.

Su1L.5 • 09:30
Frequency Noise Measurement of Narrow-Linewidth Laser Based on an Optoelectronic Oscillator, Huanfa Peng¹, Rui Guo¹, Huayang Du¹, Yongchi Xu¹, Cheng Zhang¹, Lixin Zhu¹, Juhao Li¹, Jingbiao Chen¹, Weiwei Hu¹, Zhangyuan Chen¹; ¹Peking Univ., China. A novel method of frequency noise measurement of narrow-linewidth laser based on an optoelectronic oscillator is proposed and demonstrated. Theoretical analysis is presented and frequency noise measurement results of two narrow-linewidth lasers are experimentally obtained.

Magnolia, Track 1**Su1A.4 • 09:45**

Self-Similar Pulse Compression at Mid-Infrared Spectral Region in Tapered Tellurite Photonic Crystal Fiber, Feng Xu¹, Chao Mei¹, Yuan Jinhui^{1,2}, Feng Li^{2,3}, Zhe Kang², Binbin Yan¹, Kuiru Wang¹, Xinzhu Sang¹, Xian Zhou², Kang Ping Zhong², Chongxiu Yu¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China; ²Photonics Research Centre, Dept. of Electronic and Information Engineering, The Hong Kong Polytechnic Univ., China; ³The Hong Kong Polytechnic Univ. Shenzhen Research Inst., China. We propose a tapered tellurite photonic crystal fiber to achieve self-similar pulse compression at mid-infrared spectral region. Simulation results show that a 1-ps input pulse can be compressed to 62.23 fs along with negligible pedestal.

Su1A.5 • 10:00

Few layer antimonene decorated microfiber as an all-optical threshold and wavelength converter for all optical signal processing, Yufeng Song¹, Yunxiang Chen¹, Xiantao Jiang¹, Zhiming Liang¹, Weiyuan Liang¹, Yanqi Ge¹, Han Zhang¹; ¹Shenzhen Univ., China. We experimentally investigated the broadband nonlinear optical response of highly stable few-layer antimonene (FLA) by performing a Z-scan laser measurement. FLA was deposited into the microfiber as a FLA-decorated microfiber, which is feasible not only for all-optical thresholding, but also for wavelength converting in optical signal processing.

10:30–12:30 **Su2A • Poster Session, Coffee Break, and Exhibition, Exhibition Area****Hydrangea, Track 2****Su1B.5 • 09:45**

A Novel Coded Modulation Scheme Based on Polar Code, Fei Xiao², Liu Bo¹, Lijia Zhang², Xiangjun Xin², Qi Zhang², Qinghua Tian², Feng Tian¹, Yongjun Wang², Lan Rao², Deng'ao Li³, Fu Wang²; ¹Inst. of Optoelectronics, Nanjing Univ. of Information Science & Technology, China; ²School of Electronic Engineering, Beijing Univ. of Posts and Telecommunications, China; ³College of Information Engineering, Taiyuan Univ. of Technology, China. A novel coded modulation scheme based on Polar code is proposed, which combines the advantages of both polar code and trellis-coded modulation. Under the same BER, the proposed scheme requires lower SNR, lower coding complexity and can achieve channel capacity closer to tolerance to the Shannon limit.

Su1B.6 • 10:00 Invited

Artificial Neural Networks for Fiber Nonlinear Noise Estimation, Aazar Saadaat Kashi¹, Qunbi Zhuge², John Cartledge¹, Andrzej Borowiec², Douglas Charlton², Charles Laperle², Maurice O'Sullivan²; ¹Queen's Univ., Canada; ²Ciena Corporation, Canada. Application of machine learning techniques in fiber nonlinearity (or equivalently OSNR) monitoring is proposed and investigated. High monitoring accuracy is demonstrated for a wide range of link conditions using an artificial neural network.

10:30–11:40 **Postdeadline Sessions, Bauhinian and Dahlia Rooms****Hibiscus, Track 2****Su1C.6 • 09:45**

Security Enhancement for OFDMA-PON Using Chaotic Turbo Trellis-Coded Modulation, Huijuan Zhang¹, Chongfu Zhang¹, Yang Y. Yan¹, Wei Zhang¹, Kun Qiu¹; ¹School of Communication and Information Engineering, Univ. of Electronic Science and Technology of China, China. We propose a chaotic turbo trellis-coded modulation scheme based on Brownian motion encryption for OFDMA-PON. The experiment results demonstrated in an IM/DD system verify that the scheme can simultaneously improve the security and transmission performance.

Su1C.7 • 10:00

Stream-binary-data padded Digital Multicarrier DP-M-QAM for Secure Bi-directional Optical Transmission, Takahiro Kodama¹, Masanori Hanawa¹; ¹Yamanashi Univ., Japan. We propose and demonstrate a multicarrier DP-M-QAM system using stream-binary-data padding scheme for secure bi-directional transmission. The computational confidentiality of the proposed scheme is drastically overcome a commercialized 256-bit AES algorithm.

Begonia, Track 3**Su1D.4 • 09:45**

Periodic and Disordered Plasmonic Nanostructures Arrays for Visualization Application, Hervé Bertin¹, Yoann Brûlé², Giovanni Magno¹, Thomas Lopez¹, Philippe Gogol¹, Laetitia Pradere³, Boris Gralak², David Barat³, Guillaume Demésy², Beatrice Dagens¹; ¹C2N, CNRS, Université Paris-Sud, Université Paris-Saclay, France; ²Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, France; ³PSA AUTOMOBILES S.A., Direction Scientifique, Centre technique de Vélizy, France. Periodic and disordered silver nanoparticle arrays on glass are characterized and compared in transmission and reflection for visualization application, in the case of monochrome (one single size) or bichrome (two nanoparticle sizes) operation.

Su1D.5 • 10:00

Design of nanostructured adiabatic waveguide tapers with ultra-short lengths, Lu Liu¹, Yingjie Liu¹, Ke Xu¹; ¹Harbin Inst. of Technology, Shenzhen, China. Nanostructured adiabatic waveguide tapers with ultra-short lengths are designed by algorithm. The transmission efficiencies of all the designed tapers are above 90% which are much higher than those linear taper with the same taper length.

Su1D.6 • 10:15

Polarization Independent Fiber-to-Waveguide Coupling by Hexagon Dots/Holes Grating, Wanqiang Zhang¹, Wenjia Zhang¹, Fan Yang¹, Zuyuan He¹; ¹Shanghai Jiaotong Univ., China. We propose a hexagon dots/holes grating to realize polarization independent fiber-to-waveguide coupling. The coupling efficiency with arbitrary polarization for vertical coupler and for quasi-vertical coupler reaches -4.56 ± 0.15 dB and -5.7 ± 0.53 dB, respectively.

Orchid, Track 4**Su1E.3 • 09:45 Invited**

Microwave Photonic Devices Based on High-Q AIN Microring Resonators, Changzheng Sun¹, Xianwen Liu¹, Bing Xiong¹, Lai Wang¹, Zhibiao Hao¹, Jian Wang¹, Yanjun Han¹, Hongtao Li¹, Yi Luo¹, Jianchang Yan², Tongbo Wei², Yun Zhang², Junxi Wang²; ¹Dept. of Electronic Engineering, Tsinghua Univ., China; ²Inst. of Semiconductors, CAS, China. High-Q microring resonators are fabricated based on the AIN-on-sapphire platform, and their applications in microwave photonics are demonstrated, including all-optically tunable microwave phase shifters and optical frequency combs.

Su1E.4 • 10:15

Single Passband Microwave Photonic Filter using a Dual-Parallel Mach-Zehnder Modulator, Shijie Song¹, Shuo Zhang¹, Bo Liu¹, Suen Xin Chew¹, Xiaoke Yi¹, Linh Nguyen¹; ¹Univ. of Sydney, Australia. We present a novel approach to realize a phase-compensated tunable microwave photonic filter (MPF) via employing a dual-parallel Mach-Zehnder modulator (DPMZM). Proof-of-concept experimental results demonstrate a tunable single passband filter while exhibiting an improved selectivity.

Dahlia, Track 5**Su1F.4 • 09:45**

A channel analysis method for ground-air wireless communication system, Zhiqiang Wei¹; ¹*Xi'an electronics engineering Inst., China. Analysis on different wireless channel models which are applicable for different communication areas under ground-air wireless communication scenario is presented. Also, a simulation method which aims at computing the link remaining power is proposed in this paper.*

Su1F.5 • 10:00

Efficient crystalline Silicon planar metalens towards fiber optical tweezers, Yumin Qiu^{1,3}, Haowen Liang^{1,3}, Jiahui Wang^{1,3}, Juntao Li^{1,3}, Thomas F. Krauss⁴, Zhigang Cai^{1,2}; ¹*School of Physics, Sun Yat-sen Univ., China;* ²*National Demonstration Center for Experimental Physics Education, Sun Yat-sen Univ., China;* ³*State Key Laboratory of Optoelectronic Materials and Technology, Sun Yat-sen Univ., China;* ⁴*Dept. of Physics, Univ. of York, UK. We simulate a c-Si based planar metalens which enables circularly polarized Gaussian light to efficiently focus. By assembling metalens with the optical fiber, a novel fiber optical tweezers is designed with high optical efficiency.*

10:30–12:30 Su2A • Poster Session, Coffee Break, and Exhibition, Exhibition Area

10:30–11:40 Postdeadline Sessions, Bauhinian and Dahlia Rooms

Napoleon, Track 6**Su1G.5 • 09:45**

Luminescence property of Ce³⁺-doped yttrium aluminum garnet (YAG:Ce) synthesized by co-precipitation, Zhou You^{1,4}, Jialei Zhang^{1,4}, Wenyun Luo^{1,4}; ¹*School of Environmental and Chemical Engineering, Shanghai Univ., China;* ⁴*Shanghai Applied Radiation Inst., Shanghai Univ., China. The Ce³⁺-doped YAG-based powders have been synthesized with co-precipitation method. XRD spectra show a crystal phase. PL measurement shows that the luminescence spectrum is a broad emission band centered at 550 nm.*

Louis XIII, Track 7**Su1H.4 • 10:00**

Ab initio study of the role of oxygen and excess electrons in the degradation of CH₃NH₃PbI₃, Zhang Linghai¹; ¹*City Univ. of Hongkong, China. The interactions between the MAI-terminated MAPbI₃ (110) surface and O₂ molecules in the presence of excess electrons were studied by density functional theory calculations. We identify a pathway for the formation of the PbO local structure and demonstrate the key roles of excess electrons and oxygens in MAPbI₃ degradation.*

Su1H.5 • 10:15

solution-processing interface layers for high performance perovskite solar cells, Wenhui Zhang¹; ¹*South China Normal Univ., China. In this talk, we demonstrate a high-efficiency inverted planar perovskite solar cell, obtained with a simple wet-chemistry based, room-temperature, and cost-effective processing. The resulted best cell with a FF as high as 80.7% and a remarkable improvement PCE of ~16%, which exceeds the PCE of a device without the interface layers (~11.2%).*

Marigold, Track 8**Su1I.3 • 09:45**

Invited
Viscoelasticity Measurement Using Laser Speckle Techniques, Pengcheng Li¹, Jinling Lu¹, Xiao Chen¹; ¹*Wuhan National Laboratory for Optoelectronics, Huazhong Univ of Science and Technology, China. Optical elastography has recently attracted extensive attention due to its high resolution and high sensitivity. Here the progress in viscoelasticity measurement methods based on laser speckle was discussed. The advantages and limitations of different methods were compared in details.*

Su1I.4 • 10:15

Ultrafast and broadband inertia-free swept source for optical coherence tomography, Jiqiang Kang¹, Pingping Feng¹, Xiaoming Wei¹, Edmund Y. Lam¹, Kevin K. Tsia¹, Kenneth K. Wong¹; ¹*The Univ. of Hong Kong, China. We demonstrate an optical coherence tomography system with a 44.5-MHz repetition rate, 102-nm optical bandwidth inertia-free swept source. Two- and three-dimensional mud-fish eye anterior segment imaging was conducted with 10- μ m resolution in tissue.*

Bauhinia, Track 3**Su1K.4 • 09:45**

Invited
Monolithic Integration of III-V Quantum Dot Lasers on Silicon for Silicon Photonics, Huiyun Liu¹; ¹*Univ. College London, UK. The silicon-based telecommunications-wavelength III-V quantum-dot lasers with extremely low threshold current density, high output power, and long lifetime will be presented, and hence be a new platform for silicon-photonics integration.*

Su1K.5 • 10:15

4 channel EAM modulated DBR laser array, Yunlong Liu¹; ¹*Inst Semiconductors, CAS, China. Monolithically integrated 4 channel electroabsorption modulated DBR lasers array is fabricated. The DBR lasers have over 11 nm wavelength turning range. The small signal modulation bandwidth of the integrated EAM is around 10 GHz.*

Kapok, Joint**Su1L.6 • 09:45**

Brillouin optical time domain analyzer with FSK probe wave, Sheng Wang¹, Xiaobin Hong¹, Xizi Sun¹, Jian Wu¹; ¹*Beijing Univ. of Posts and Telecom., China. We propose a novel BOTDA technique based on FSK modulated probe for enhancing the probe power to +5 dBm. This technique is experimental demonstrated in a 105-km-long fiber with 2 m spatial resolution.*

Su1L.7 • 10:00

Resonance Wavelength Sensitivity due to Pressure and Temperature Changes for Mechanically-induced Long Period Fiber Grating in the 850-nm Wavelength Range, Takahiro Hase², Yasuhiro Tsutsumi¹, Masaharu Ohashi¹, Hirokazu Kubota¹, Yuji Miyoshi¹; ¹*Osaka Prefecture Univ., Japan;* ²*Osaka Prefecture Univ., Graduate School of Engineering, Japan. We investigated the resonance wavelength sensitivity due to pressure and temperature changes for mechanically-induced long period fiber grating fabricated with a heat-shrinkable tube from a viewpoint of optical sensor.*

Su1L.8 • 10:15

De-correlation Bandwidth Evolution of Frequency Dependent Crosstalk in Weakly Coupled Multicore Fiber, Lin Gan¹, Li Shen¹, Chen Xing¹, Borui Li¹, Yanpeng Li¹, Songnian Fu¹, Changjian Ke¹, Deming Liu¹, Weijun Tong², Ming Tang¹; ¹*Next Generation Internet Access National, USA;* ²*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China. It was experimentally confirmed for the first time that the de-correlation bandwidth of crosstalk in multicore fiber decreases by fractional linear function with transmission length, which is help for building channel model of multicore fiber.*

Poster Session

10:30–12:30

Su2A • Poster Session

Su2A.1

Study on the Power Distribution of Non-symmetric Y Branch Waveguide Based on BPM, Jinlong Zhang¹, Jingan Long¹, Heng Lai¹, Minxue Wei¹, Zigang Zhou¹; ¹Southwest Univ. of Science and Technology, China. Seeming single-mode Y-branch plane waveguide as the research object. Researching on its simulated parameters of structures by the total internal reflection theory and the BPM based on Rsoft software. Getting the results of the light passing conditions, power characteristics and mode field distribution under different asymmetric conditions.

Su2A.2

Silicon-on-Insulator First-Order Mode Converter Based on Binary Phase Plate, Basma E. Abu-Elmaaty¹, Omnia Nawwar¹, Hossam M. Shalaby^{1,2}, Ramesh K. Pokharel³; ¹ECE, Egypt-Japan Univ. of science and technology (E-JUST), Egypt; ²Electrical Engineering Dept., Alexandria Univ., Egypt; ³Graduate School of Information Science and Electrical Engineering, Kyushu Univ., Japan. A silicon-on-insulator fundamental to first-order mode converter is proposed based on binary phase plate. The proposed device has a simple and compact structure. It has a low insertion loss of -2 dB and low crosstalk.

Su2A.3

Fast and ultrasensitive detection of toxic heavy metals in water by LIBS-LIF technique, Juan Kang¹, Yarui Wang¹, Yuqi Chen¹, Runhua Li¹; ¹South China Univ Tech, China. To realize ultrasensitive detection of toxic heavy metals in water, LIBS-LIF combined with special sample pretreatment method was investigated in detail. Ultrasensitive detection of lead and copper in water could be realized within short time.

Su2A.4

One-way propagation of bulk states in photonic crystals with breaking time-reversal and inversion symmetries, Jin c. Lu¹, Xiao-Dong Chen¹, Jian-Wen Dong¹; ¹Sun Yat-sen Univ., China. Valley is an inevitable degree of freedom for light manipulation in photonic systems. Here, we introduce the valley concept into photonic crystals with breaking time-reversal and inversion symmetries, leading to the observation of one-way propagation of bulk photonic states.

Su2A.5

Arbitrary Spectral Synthesis with High-Birefringence Sagnac Loop Filter, Haijun He¹, Liyang Shao^{1,2}, Xinpu Zhang¹, Xihua Zou¹, Lian-shan Yan¹, Wei Pan¹; ¹Southwest Jiaotong Univ., China; ²Southern Univ. of Science and Technology, China. An arbitrary spectral synthesizer with high-birefringence Sagnac loop filter based on Fourier synthesis theory has been proposed and demonstrated. Triangle, rectangle and sawtooth spectra have been synthesized and agree well with the theoretical simulations.

Su2A.6

A Cost-effective Microwave Photonic Satellite Repeater with Phase Tunable Capability, Wei Zhang¹, Bo Tian²; ¹Science and Technology on Information Systems Engineering Laboratory, National Univ. of Defense Technology, China; ²School of Electronic Engineering, Beijing Univ. of Posts and Telecommunications, China. A microwave photonic satellite repeater implementing multi-band frequency conversion with full-range phase-shift is proposed. Simulation results show the received 10GHz signal is converted to 4GHz, 20GHz, 24GHz, 30GHz and 50GHz with 360° phase shift.

Su2A.7

A Reconfigurable Optical Frequency Comb Generator with 35 Flat Comb Lines, Jinwang J. Qian¹, Xinlu Gao¹, Mingyang Zhao¹, Zheng M. Lei¹, Shanguo Huang¹; ¹Beijing Univ. of Posts and Telecommunications, China. We propose an optical frequency comb (OFC) generator with excellent spectral flatness using cascaded dual-parallel and intensity modulators. 35 comb lines with exactly the same intensity can be generated.

Su2A.8

Optoelectronic oscillator's frequency fine control based on band pass filter temperature variation, Zhengyang Xie¹, Shangyuan Li¹, Haozhe Yan¹, Xuedi Xiao¹, Xiaoxiao Xue¹, Xiaoping Zheng¹; ¹Tsinghua Univ., China. We experimentally demonstrated the linear relationship between the band pass filter's thermal variation and OEO frequency shift in 10 minute. With BPF temperature increasing 1 degree, the OEO frequency would shift 640Hz in the experiment.

Su2A.9

A photonic microwave frequency quadrupler for wideband radar signal generation, Zhengyang Xie¹, Yu Zha¹, Xuedi Xiao¹, Shangyuan Li¹, Haozhe Yan¹, Xiaoxiao Xue¹, Xiaoping Zheng¹; ¹Tsinghua Univ., China. We demonstrate a wideband radar signal generation by using a photonic microwave frequency quadrupler and direct digital synthesis. DP-DPMZM is employed for LFM waveform quadrupling generation and the 8-12GHz high quality signal is obtained experimentally.

Su2A.10

An Optoelectronic Oscillator based on Self-Injection-Locked Monolithic Integrated Dual-mode Amplified Feedback Laser, Guangcan Chen^{1,2}, Dan Lu^{1,2}, Lu Guo^{1,2}, Qiufang Deng^{1,2}, Wu Zhao^{1,2}, Lingjuan Zhao^{1,2}; ¹Key Laboratory of Semiconductor Materials Science, Inst. of Semiconductors, Chinese Academy of Sciences, China; ²College of Materials Science and Opto-Electronic Technology, Univ. of Chinese Academy of Sciences, China. An optoelectronic oscillator using dual-mode amplified feedback laser under self-injection is proposed. Microwave signal ranging from 37.59 to 43.59 GHz with SSB phase noise below -94.87 dBc/Hz at 10 kHz frequency offset was successfully obtained.

Su2A.11

Photonics defined radio: concept, architecture and applications, Bai Q. Zong¹, Xiaohong Zhang¹, Xiaotong Li¹, Jianli Wang¹, Yijun Cui¹; ¹ZTE CORP, China. Photonics defined radio, a new and possibly standardized paradigm, is proposed, converging integrated coherent optics, integrated microwave photonics and photonic DSP, and expected to dominate the designs of future communication and sensing systems. The applications of photonics defined radio are also discussed in brief.

Su2A.12

Stimulated Brillouin Scattering-based Switchable Microwave Photonic Filter, Jun Gu¹, Fei Wang², Youxi Lu¹, Mengmeng Peng¹, Lun Shi², Chang-Hee Lee³; ¹School of Science, Chongqing Univ. of Technology Chongqing, China; ²School of Electrical and Electronic Engineering, Chongqing Univ. of Technology, China; ³Korea Advanced Inst. of Science and Technology, Korea. A novel microwave photonic filter based on phase modulation and stimulated Brillouin scattering is proposed and experimentally demonstrated, which can be switched between bandpass and notch filter only by adjusting polarization direction of pump light.

Su2A.13

Dynamic range improvement for a microwave photonic link using a phase modulator, Jin Zhang¹, Anle Wang¹, Yalan Wang¹, Lan Yu¹, Pengfei Du¹, Daoming Zhang¹, Wenshan Cong¹, Jianghai Wo¹; ¹Wuhan Electronic Inst., China. A novel single band phase modulated microwave photonics link (MPL) with improved spurious-free dynamic range (SFDR) is proposed. A SFDR of 128.582 dB*HZ^{2/3} is obtained in the simulation experiment.

Su2A.14

Distance-Adaptive Multilayer Traffic Grooming Approaches in IP-Over-Flexible Bandwidth Optical Networks, Jie Zhang¹, Bowen Chen¹, Mingyi Gao¹, Xiaoling Wang¹; ¹Soochow Univ., China. A distance-adaptive multilayer traffic grooming approach (MLTGA) is proposed to improve spectrum efficiency and to save power consumption and both IP-layer and optical-layer traffic grooming approaches (ILTGA and OLTGA) are introduced. Results show that MLTGA has a better blocking probability and power consumption compared to ILTGA and OLTGA.

Su2A.15

Noise Tolerance in Optical Waveguide Circuits for Recognition of 2-symbol Optical 8QAM Codes, Tumendemberel Surenkhorol¹, Hiroki Kishikawa¹, Nobuo Goto¹; ¹Tokushima Univ., Japan. We have proposed waveguide-type recognition circuits for 1- and 2-symbol optical eight quadrature amplitude (8QAM) coded labels and an operation was theoretically analyzed [1]. This work discusses a noise tolerance for these circuits.

Su2A.16

Photonic Generation of Continuous Pulse Based on Injection Locking, Tianyu Li¹, Ju Wang¹, Ying Liang¹, Jinlong Yu¹; ¹Tianjin Univ., China. By injection locking the first sideband of modulated light, the optical spectrum is broadened because of four-wave mixing (FWM) effect. As a result, continuous optical pulse with same frequency of modulating microwave is generated.

Poster Session

Su2A.17

Ergodic Capacity of MIMO FSO Links with Combined Effects over Log-Normal Channel, Minghua Cao¹, Yue Zhang¹, Huiqing Wang¹; ¹*School of Computer & Communication, Lanzhou Univ. of Technology, China*. The ergodic channel capacity of MIMO FSO systems with combined effects is investigated under log-normal turbulence channel. The results indicate that the receive diversity can partly mitigate the impact of combined effects.

Su2A.18

All Optical Format Conversion of 8-PSK to 4-PAM Signals Based on Phase Sensitive Amplification, Hongxiang Wang¹, Qi Wang¹, Yuefeng Ji¹; ¹*State Key Laboratory of Information Photonics and Optical Communications, School of Information and Communication Engineering, Beijing Univ. of Posts and Telecommunications, China*. A scheme is proposed to convert an 8-PSK signal to two 4-PAM signals based on phase sensitive amplification. System performance is evaluated by error vector magnitude and bit error rate of input and output signals.

Su2A.19

Viterbi Estimation on the Finite-State Markov Ultra-violet Channels, Zhuangkun Wei¹, Wenxiu Hu¹, Min Zhang¹, DaHai Han¹, Bin Li¹, Chenglin Zhao¹; ¹*Beijing Univ. of Posts and Telecom, China*. This article addresses the inter-symbol interference (ISI) of Ultraviolet (UV) communications driven by scattering effect. We model UV channel-state-information (CSI) as Markov finite-state and design Viterbi scheme to estimate informative bits.

Su2A.20

The Down-link Propagation Modeling for Underwater Laser Communication, Siqi Hu^{1,2}, Le Mi^{1,2}, Tianhua Zhou¹, Jian Ma¹, Tingting Lu¹, Xiaolei Zhu¹, Weibiao Chen¹; ¹*Key Laboratory of Space Laser Communication and Detection Technology, Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China*; ²*Univ. of Chinese Academy of Sciences, China*. A down-link propagation model was set based on Monte Carlo simulation, and the comprehensive influence of sea wave, water channel and receiver system has been considered. The down-link propagation model has been validated by practical received results.

Su2A.21

Outage Probability Analysis for Gamma-Gamma Turbulence FSO in haze, Lin Fu¹, Yunfeng Peng¹, Yan Sui², Chen Chen²; ¹*Univ. of Science and Technology Beijing, China*; ²*Space Star Technology Co. Ltd, Zhichun Road 82 Haidian Beijing, China*. A FSO atmospheric channel model for Gamma-Gamma turbulence in dry haze is derived, and the outage probability of this model is simulated and analyzed on dry haze data for Beijing winter.

Su2A.22

Non-Orthogonal Multiple Access for Visible Light Communications, Bangjiang Lin¹, Kaiwei Zhang¹, Yu Tian¹, Yuanxiang Chen¹, Xuan Tang¹, Mln Zhang¹, Yi Wu¹, Hui Li¹; ¹*Quanzhou Inst. of Equipment Manufacturing, Haixi Inst.s, Chinese Academy of Sciences, China*. We propose a NOMA scheme combined with OFDMA for visible light communications, which offers a high throughput, flexible bandwidth allocation and a higher system capacity for a larger number of users.

Su2A.23

Research on passband narrowing effect of cascaded WSS in various ROADMs links, Junsen Lai¹, Rui Tang¹, Bingbing Wu¹, Shaohui Li¹, Xin Zhao¹, Xiaohua Tang¹, Wenyu Zhao¹, Haiyi Zhang¹; ¹*CAICT, China*. The impact of passband narrowing effect introduced by cascaded WSS in ROADM application is investigated by simulation. Different conditions include fix/flex-grid channel, four kinds of modulation formats and three types of filter shape.

Su2A.24

The application of the backward-pumped random fiber laser in realizing a quasi-lossless optical fiber transmission system, You Wang^{1,3}, Qiguang Feng^{1,3}, Qiang Zheng^{1,3}, Wei Li^{1,3}, Jiekui Yu², Liyan Huang²; ¹*Huazhong Univ. of Science and Technology, China*; ²*Accelink Technologies Company Ltd, China*; ³*Wuhan National Lab for Optoelectronics, China*. We applied the backward-pumped random fiber laser in the conventional distributed Raman amplification to minimize the signal power variation along the fiber in order to realize a quasi-lossless system.

Su2A.25

Hybrid Transmission of Laser and Microwave Based on Dual-wavelength Brillouin Fiber Laser, Qingsong Jia¹, Tianshu Wang¹, Wanzhuo Ma¹, Huilin Jiang¹, Baoxue Bo¹; ¹*Changchun Univ. of Science and Technology, China*. A laser and microwave hybrid transmission system based on dual-wavelength Brillouin fiber laser is proposed and demonstrated. Laser and microwave hybrid transmission is achieved through experimental analysis.

Su2A.26

OSNR Estimation Algorithm for Higher-order Modulation Formats in Coherent Optical Systems, Xiang Lin¹, Octavia A. Dobre¹, Oluyemi Omomukuyo¹, Yahia Eldemerdash¹, Cheng Li¹; ¹*Memorial Univ. of Newfoundland, Canada*. We propose a blind OSNR estimation algorithm. Simulations show that its mean square error is smaller than that of the conventional moment-based algorithm. The estimation error is experimentally demonstrated to be less than 0.6 dB.

Su2A.27

Bidirectional SSB modulation for Hybrid-PON with source-free optical network units, Xiao I. Zhang¹, Chongfu Zhang¹, Chen Chen², Mingyue Zhu¹, Wei Jin¹, Kun Qiu¹; ¹*Univ. Electron. Sci. & Technol. China, China*; ²*School of Electrical and Electronic Engineering, Nanyang Technological Univ., 639798, Singapore, Singapore*. A bidirectional SSB modulation based PON with source-free optical network units is proposed, where orthogonal frequency division multiple based carrierless amplitude and phase is employed in the downstream while WDM is utilized in the upstream.

Su2A.28

Nonlinearity Mitigation of RoF Signal Using Machine Learning Based Classifier, Yuanxiang Chen¹, Yongtao Huang¹, Jianguo Yu¹; ¹*Beijing Univ. of Posts and Telecommunications, China*. To mitigate nonlinear constellation distortion in discrete multi-tone (DMT) modulated radio over fiber system, two machine learning methods (KNN and SVM) are proposed for received signal decision. The simulation results show that both methods can effectively reduce the bit error rate.

Su2A.29

Modulation format identification based on density distributions in Stokes plane for digital coherent receivers, Anlin Yi¹; ¹*Southwest Jiaotong Univ., China*. A MFI technique based on extracting specific features of received signal density distributions in Stokes plane is proposed for digital coherent receivers. Correct MFI can be realized among five pol-muxed modulation formats with low complexity.

Su2A.30

Experimental Demonstration of an NOMA Scheme for Passive Optical Network, Bangjiang Lin¹, Kaiwei Zhang¹, Yu Tian¹, Yuanxiang Chen¹, Xuan Tang¹, Mln Zhang¹, Yi Wu¹, Hui Li¹; ¹*Quanzhou Inst. of Equipment Manufacturing, Haixi Inst.s, Chinese Academy of Sciences, China*. We propose NOMA-OFDM for PON, which offers a high throughput, high resistance to fiber dispersion and a higher system capacity. Bidirectional NOMA-OFDM-PON transmission is experimentally demonstrated.

Su2A.31

Realization of -90°~90° continuous polarization rotation with high efficiency broadband transmission based on periodically arranged L-shaped particles, Tong Li^{1,2}, Xiaobin Hu^{1,2}, guofeng Song^{1,2}; ¹*Inst. of Semiconductors, CAS, China*; ²*College of Materials Science and Opto-Electronic Technology, Univ. of Chinese Academy of Sciences, China*. We realize -90° to 90° optical rotation with a high efficiency (>0.9) and a high degree of linear polarization (>0.9) over a broad wavelength range (100nm) using a plasmonic metasurface composed of thick L-shaped nanoparticles.

Su2A.32

Modulation Characteristics of Reflective Quantum Dot Semiconductor Optical Amplifiers, Yin Yu¹, Ling Yun¹, Jie Chen¹, Hao Li¹, Mian Zheng², Kun Qiu¹; ¹*Univ. of Electronic Science and Technology of China, China*; ²*Southwest Petroleum Univ., China*. G-I relation linear range and modulation bandwidth of R-QDSOA are investigated. The results showed that R-QDSOA had higher G-I relation linear range and the modulation bandwidth easily reached above 17GHz, which could be further improved by optimizing parameters.

Su2A.33

High Sensitive Homodyne Receiver for Free Space Laser Communication, Chaolei Yue^{1,2}, Xiaoxi Zhang¹, Lei Liu¹, Jianfeng Sun¹, Weibiao Chen¹, Ren Zhu¹; ¹*Key Laboratory of Space Laser Communication and Detection Technology, Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China*; ²*Univ. of Chinese Academy of Sciences, China*. A high sensitive coherent receiver for free space laser communication was demonstrated. Based on a digital Costas phase-locked-loop, a sensitivity of -58dbm was achieved with bit error rate below 10⁻³ at bit rate of 1Gbps.

Su2A.34

High-precision and Low-complexity Symbol Synchronization Algorithm Based on Dual-threshold Amplitude Decision for IMDD OFDM-PON, Junjie Peng¹, Yaqian Tian¹, Youxiang Qin¹, Weilong Wang¹, Junjie Zhang¹; ¹*Shanghai Univ., China*. In this paper, we propose a low-complexity and high-precision optical OFDM-PON dual threshold symbol synchronization algorithm based on amplitude decision, which achieves 0 sampling point offset and 0 error synchronization rate through the experiment.

Su2A.35

Transmission Performance of 5x112-Gb/s Super-Nyquist-WDM PM-QPSK over Unrepeated Raman-amplified Link, Anlin Yi¹, Kehang Xu²; ¹*Southwest Jiaotong Univ., China*; ²*Southwest China Branch of Sate Grid Corporation of China, China*. We investigate the transmission performance of 5x112-Gb/s super-Nyquist PDM-QPSK over unrepeated Raman-amplified link. The results show that the optimum signal launch power is ~2dB lower for WDM than for single carrier transmission over 200-km SSMF.

Su2A.36

Security-Enhanced OFDM-PON Based on DFT and Subcarrier Scramble, Shuqing Lin¹, Ning Jiang¹, Jiajia Yu¹, Guilan Li¹, Chao Wang¹, Chenpeng Xue¹, Kun Qiu¹; ¹*UESTC, China*. We have experimentally demonstrated a novel security enhanced OFDM-PON based on DFT and chaos subcarrier scramble in an 8.85Gb/s@25km SSMF transmission system. The key space is over 10⁹⁰ to be against exhaustive attack effectively

Poster Session

Su2A.37

Continuous Control in Multi-Mode Fiber Mode-Forming Networks, Joji Oshima¹, Katsushi Iwashita¹, Hirokazu Kobayashi¹, Bishal Poudel¹, ¹Kochi Univ. of Technology, Japan. We have proposed mode-forming networks which can transmit desired signals to the only desired output port in conventional multi-mode optical fiber networks. Stable operation is demonstrated by feedback controlling amplitudes and phases of input signals.

Su2A.38

Security-enhanced DFMA-PON Based on Three-dimensional Chaos Encryption, Yang y. Yan¹, Chongfu Zhang¹, Huijuan Zhang¹, Kun Qiu¹, ¹Univ. Electron. Sci. & Technol. China, China. A secure enhanced DFMA-PON using phase masking and hybrid time-frequency chaotic scrambling is experimentally demonstrated. The experiment results verified that the proposed method is a promising solution for physical secure DFMA-PON.

Su2A.39

A Novel Pilot Pattern Channel Estimation Scheme with MMSE-DFT for MIMO-OFDM VLC System, J He¹, Zhiqi Li¹, Jin Shi¹, Rui Zhang¹, Changqing Xiang¹, Lin Chen¹, ¹Hunan Univ., China. A novel pilot pattern channel estimation scheme with MMSE-DFT is proposed for 2x2 MIMO-OFDM VLC system. The simulation results show that a 3dB promotion of SNR is obtained compared to STBC based scheme for 32-QAM format with BER below FEC threshold of 3.8×10^{-3} .

Su2A.40

Random Number Generation Using a Broadband Chaotic Signal at 1.6 Tb/s, Anke Zhao¹, ¹UESTC, China. We propose a scheme for fast random number generation with a broadband chaotic signal generated by injecting the signal of a traditional chaotic external-cavity semiconductor laser into a spectrum expansion module.

Su2A.41

Experimental Demonstration of Adaptive Non-Line-of-Sight Underwater Wireless Optical Transmission Employing Orbital Angular Momentum Mode, Yifan Zhao^{1,2}, Chengkun Cai¹, Lulu Wang^{1,2}, Shuhui Li¹, Jian Wang¹, ¹Huazhong Univ of Science and Technology, China; ²Shenzhen Inst. of Huazhong Univ. of Science and Technology, China. We demonstrate a non-line-of-sight underwater OAM mode transmission utilizing total internal reflection on the water surface. To overcome the reflection angle offset, we develop an adaptive system using two phase-only spatial light modulators to maintain a stable output path.

Su2A.42

Influence of Laser Phase Noise on the Performance of Quantum Noise Stream Ciphred Coherent Optical Transmission System, Huixi Li¹, Guanjun Gao¹, Cheng Xu¹, Jie Zhang¹, ¹BUPT, China. The performance of Quantum Noise Stream Ciphred coherent optical transmission system is investigated under influence of laser phase noise. The laser linewidth tolerance of QNSC-64QAM is lower than QPSK by 3-MHz at OSNR penalty of 2-dB.

Su2A.43

Study of Different PAM4 Distributions to Maximize the Mutual Information, Xiao Han¹, Ivan B. Djordjevic¹, ¹Electrical and Computer Engineering, Univ. of Arizona, USA. We study the transmission of different uniform and nonuniform PAM4 signal schemes through the AWGN channel and then compare the mutual information to find out the best way to approach the Shannon limit, when using the Maxwell-Boltzmann distribution.

Su2A.44

Experimental Demonstration of IDMA-OFDM for Downlink Visible Light Communication, Yunfeng Wei¹, Bangjiang Lin², Xuan Tang², Lian-gyi Ma¹, Mln Zhang², Chun Lin², Zhenlei Zhou², Haiguang Zhang², Xiaohuan Shen², Junxiang Xu², Zabih Ghassemloo³, Yi Wu¹, Hui Li¹, ¹Fujian Provincial Engineering Technology Research Center of Photoelectric Sensing Application, Fujian Normal Univ., China; ²Quanzhou Inst. of Equipment Manufacturing, Haixi Inst.s, Chinese Academy of Sciences, China; ³Optical Communications Research Group, Faculty of Engineering and Environment, Northumbria Univ., UK. We propose an IDMA scheme combined with OFDM for downlink visible light communication. The experiment results indicate that IDMA-OFDM offers better bit error rate performance compared with OFDMA.

Su2A.45

Optimal Transmission Scheme for a Nonlinear VLC System Based on Maximizing SNDR, Meijun Gao¹, Chao Li¹, Zhengyuan Xu^{1,2}, ¹USTC, China; ²Shenzhen Graduate School, Tsinghua Univ., China. We propose an optimal transmission scheme for a nonlinear VLC system based on maximizing signal to noise and distortion ratio (SNDR). Distortions caused by LED nonlinearity and receiver saturation are jointly optimized for the first time.

Su2A.46

Layer-aware based FEC allocation algorithm for Unequal Error Protection of video streaming over FSO channels, Xuan Zhang¹, Xingjun Zhang¹, ¹Xi'an Jiaotong Univ., China. A novel FEC redundancy allocation algorithm for video streaming over FSO channels was proposed. Simulation results show that the proposed algorithm outperforms the traditional equal error protection (EEP) scheme in various FSO channel status.

Su2A.47

Theoretical Performance Limits of Coherent Optical Receiver with Liquid Nitrogen Cooling, Mengxiang Han¹, Guanjun Gao¹, Cheng Xu¹, Jingwen Li¹, Jie Zhang¹, ¹Beijing Univ. of Posts and Telecomm, China. We investigate theoretical limit of coherent optical receiver with liquid nitrogen cooling to reduce thermal noise with extremely high sensitivity requirement. The transmission reach is increased by 4-km for unamplified PDM-QPSK/ PDM-16QAM at 28-Gbaud.

Su2A.48

300-km Unrepeated Transmission of 28-Gbaud 16QAM with Bidirectional Raman Amplification and Split DBP, Qiang Zheng¹, You Wang¹, Qiguang Feng¹, Jinyao Wang¹, Wei Li¹, Liyan Huang², Jiekui Yu², ¹Wuhan National Lab for Optoelectronics, China; ²Accelink Technologies Co., Ltd., China. A 300-km transmission of 28-Gbaud 16QAM modulation was demonstrated by simulation with our proposed split DBP scheme, which can mitigate the extra NSNI caused by the receiver-side DBP.

Su2A.49

Up to 128 Gb/s DP-QPSK Transmission Using Injection-locked Quantum-dash Laser for NG-PONs, Muhammad T. Khan¹, Emad Alkhazraji^{1,2}, mohamed shemis¹, Amr Ragheb³, Habib Fathallah^{4,5}, Saleh Alshebeili⁴, Mohammed Zahed Mustafa Khan¹, ¹Electrical Engineering Dept., King Fahd Univ. of Petroleum and Minerals, Saudi Arabia; ²Electrical and Electronic Technology Dept., Jubail Industrial College, Saudi Arabia; ³KACST-TIC in Radio Frequency and Photonics for the e-Society (RFTONICS), Saudi Arabia; ⁴Electrical Engineering Dept., King Saud Univ., Saudi Arabia; ⁵Computer Dept. of the College of Science of Bizerte, Univ. of Carthage, Tunisia. We demonstrate the viability of widely tunable far-L-band injection-locked quantum-dash laser as a source for NG-PONs by successful of 128 Gb/s DP-QPSK transmission over ~1621 nm subcarrier, and reaching a potential capacity of ~4.0 Tb/s.

Su2A.50

An IM-DD based 50-Gbps 40-km TDM-PON Downstream Scheme Enabled by Self-Phase Modulation, Zhijuan Tu¹, Qi Guo², Cheng Ju², Yanxu Chen², Xingang Huang¹, Zhiguo Zhang², Lei Feng², ¹ZTE Corporation, China; ²Beijing Univ. of Posts and Telecommunications, China. 50-Gbps 40-km TDM-PON downstream scheme is designed based on IM-DD and high launch power. Loss budgets of 29, 26, and 23 dB are demonstrated with different modulation formats to support 64-, 32-, and 16-ONUs.

Su2A.51

High Speed Visible Light Communications based on RGB Laser Diodes and OOK-NRZ Modulation, Honglei Li^{1,2}, ¹Inst. of semiconductors, CAS, China; ²College of Materials Science and Opto-Electronic Technology, Univ. of Chinese Academy of Sciences, China. This paper reports a high-speed OOK-NRZ visible light communication system using red, green and blue LDs, data rates of 1940Mb/s, 2660Mb/s and 2670Mb/s are obtained over distance of ~1.5m. All the BERs are below 10^{-9} .

Su2A.52

Mitigation of LED Nonlinearity Using Adaptive Equalization for Visible Light Communications, C. W. Hsu¹, Yung Hsu¹, Guan-Hong Chen¹, L. Y. Wei¹, Chi Wai Chow¹, I C², Y. L.², C. H. Yeh³, ¹National Chiao Tung Univ., China; ²Industrial Technology Research Inst., China; ³Feng Chia Univ., China. We demonstrate using bit-loading orthogonal-frequency-division-multiplexing (OFDM) and adaptive Volterra equalization to mitigate the light-emitting-diode (LED) nonlinearity; hence the data rate of LED based visible-light-communication (VLC) can be increased to > 700 Mbit/s.

Su2A.53

Design for Architecture and Router of 3D Free-Space Optical Network-on-Chip, Pengxing Guo¹, Lei Guo¹, Weigang Hou¹, Hang Liang¹, ¹School of Computer Science and Engineering, Northeastern Univ., China. In this paper, we design a novel on-chip architecture based on free-space optics. Simulation results demonstrate that our solution performs well in terms of power loss, transmission latency, consumption of energy and lasers

Su2A.54

Large Scale Routing and Wavelength Assignment Based on Genetic Algorithm, Min Zhang¹, Bo Xu¹, Baojian Wu¹, Yun Ling¹, Kun Qiu¹, ¹Univ. of Electronic Science and Technology of China, China. The routing and wavelength assignment problem in all optical networks is considered. Simulation results show that genetic algorithm based large scale RWA problem can achieve a lower blocking ratio performance than the traditional routing strategies.

Poster Session

Su2A.55

Differentiated Service supported Multicast RWA Scheme for Intelligent Optical Network, Jianhua Shen¹; ¹Nanjing Univ Posts & Telecommunications, China. An improved IRES-MRWA algorithm is proposed which combing both the priority based wavelength reservation and smart edge removal light hierarchy scheme. Simulation result shows that improved algorithm has better blocking probability performance and resource utilization.

Su2A.56

SOIN: Scalable Optical Interconnect Network for On-chip Parallel Memory Access, Yue Wang¹, Kang Wang¹, Duan Zhou¹, Kun Wang¹, Huaxi Gu¹; ¹Xidian Univ., China. An optical interconnect network SOIN is proposed for the on-chip parallel memory access with better scalability. The 8-rank SOIN is shown and compared with 4-rank SOIN in terms of bandwidth, latency and power consumption.

Su2A.57

Survivable Multicast Provisioning based on Distributed Sub-Light-Tree in Elastic Optical Datacenter Networks, Tao Gao¹, Xin Li¹, Bingli Guo¹, Shan Yin¹, Yu Shang¹, Ying Tang¹, Shanguo Huang¹; ¹Beijing Univ of Posts & Telecom, China. We develop ILP models and heuristic algorithms for survivable multicast provisioning based on distributed sub-light-trees in elastic optical data-center networks. The proposed scheme achieves higher spectrum efficiency and lower blocking probability than conventional scheme.

Su2A.58

Periodic Adaptive Threshold Estimating Method for Free Space Optical Communication, Won-Ho Shin¹, Hyoung-Joon Park¹, Sang-Kook Han¹; ¹Yonsei Univ., Korea. We proposed a periodic adaptive threshold estimating method to deal with fading in free-space optical communication. Frequency characteristic of turbulence is analyzed for optimal period of adaptive threshold. In addition, optimal threshold is estimated for lower BER and complexity.

Su2A.59

An optical access architecture with Rayleigh backscattering noise mitigation for convergence of fixed and mobile access, Qiguang Feng¹, Yuan Li², You Wang¹, Pu Zhang¹, Qiang Zheng¹, Wei Li¹; ¹Wuhan National Lab for Optoelectronics, China; ²Dept. of Computer Science, Central China Normal Univ., China. With orthogonal coding, we proposed a cost-effective ring-based optical access architecture with Rayleigh backscattering noise mitigation for optical and wireless convergence, where no extra lasers for the upstream and fewer fiber Bragg gratings are required.

Su2A.60

Modular AWG-based Optical Shuffle Network, Jingjie Ding¹, Tong Ye¹, Tony T. Lee¹, Weisheng Hu¹; ¹Shanghai Jiao Tong Univ., China. This paper proposes an arrayed-waveguide grating (AWG) based wavelength-division-multiplexing (WDM) shuffle network. Compared with previous optical shuffle networks, our proposal is compact, easy to implement, highly scalable, and cost effective.

Su2A.61

Blockchain Mechanism Based on Enhancing Consensus for Trusted Optical Networks, Siqi Kou¹, Hui Yang¹, Haowei Zheng¹, Wei Bai¹, Jie Zhang¹, Yizhen Wu²; ¹Beijing Univ. of Posts and Telecommunications, China; ²Huawei Technologies Co., Ltd., China. We achieve trusted optical networks by introducing enhancing blockchain consensus protocol which take dynamic leaders to write blocks into blockchain. Simulation results show that improved mechanism can achieve better performance.

Su2A.62

An optical and radio access network resource management scheme based on hierarchical edge cloud and baseband function split for 5G network slicing, Wei Liu¹, Min Zhang¹, Chuang Song¹, Yueying Zhan²; ¹Beijing Univ. of Posts and Telecomm, China; ²Technology and Engineering Center for Space Utilization, Chinese Academy of Science (CAS), China. An optical and radio access network resource management scheme based on hierarchical edge cloud and function split was proposed to realize the network slicing. Simulation indicates the scheme meets the requirements of different network slicing.

Su2A.63

Multi-Level Multi-Responsibility Multi-Cascade Controllers Orchestration to Improve the Latency Performance of Content Delivery Optical Networking in 5G, Bingxin Yu¹, Hui Yang¹, Wei Bai¹, Jinyu Guo¹, Siqi Kou¹, Jie Zhang¹, Hongyun Xiao²; ¹Beijing Univ. of Posts and Telecomm, China; ²ZTE Corporation, Shenzhen, China, China. The Multi-Level Multi-Responsibility Multi-Cascade Controllers Orchestration applied to content delivery optical networking is proposed and demonstrated as a resolution to improve the network performance especially for latency adapting to the 5G scenarios.

Su2A.64

Dynamic and Efficient Networking of Satellite Optical Communication for Multiple Provisional Traffic, Zhen Xing¹, Haitao Wang², Rentao Gu¹, Qize Guo¹, Zhihui Liu², Yuting Gao², Yuefeng Ji¹; ¹Beijing Univ. of Posts and Telecom, China; ²Beijing Inst. of Satellite Information Engineering, China. A topology reconstructed networking algorithm is proposed to find the minimal set of optical inter-satellite links under the guarantee of quality of service. Simulation results show that nearly 30% of links could be saved.

Su2A.65

Topology Visualization in Optical Backbone Transport Network Planning, Chen Yuanhao¹, Guochu Shou¹, Pei Zhao², Xiaoliang Li², Yihong Hu¹, Yaqiong Liu¹; ¹Beijing Univ. of Posts and Telecom, China; ²China Mobile Group Design Inst., China. We introduce some indexes of social network to the optical backbone transport network planning, evaluate the network situation, and improve the topology visualization. This work has been applied in the real project of China Mobile.

Su2A.66

Soft-Reservation based Resource Allocation in Optical Networks Secured by Quantum Key Distribution (QKD), Xian Ning¹, Yongli Zhao¹, Xiaosong Yu¹, Yuan Cao¹, Qinghai Ou², Zhu Liu², Xiao Liao², Jie Zhang¹; ¹Beijing Univ. of Posts and Telecommunications, China; ²State Grid Information & Telecommunication Group Co., LTD, China. A dynamic routing, wavelength and time-slot allocation algorithm based on soft-reservation is proposed to construct different channels in optical networks secured by QKD. Simulation shows the proposed algorithm can achieve high adaptability to security requirements.

Su2A.67

Performance Evaluation of LDPC Coded IM/DD Optical OFDM Transmission System, Yong Sun¹, Huibin Zhang¹, Jie Zhang¹, Kai Wang¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecom, China. We present a novel LDPC coded IM/DD optical OFDM system. A method of evaluating the LLR is proposed for soft demodulation. The simulation results demonstrate that the system with code rate R=1/3 has NCG of larger than 10dB at the BER= 1E-3 over 40-km transmission.

Su2A.68

Adaptive Cross-layer Resources Optimization Strategy for Hybrid Optical and Wireless Network, Jingwen Nan¹, Hui Yang¹, Wei Bai¹, Jie Zhang¹, Hongyun Xiao²; ¹BUP, China; ²ZTE, China. This paper presents an adaptive cross-layer resources optimization strategy based on hybrid optical and wireless network with software defined networking. The efficiency of the whole system is experimentally verified on test program.

Su2A.69

A Scalable Interconnect Network for High Performance Computing, Yunfeng Lu¹, Xiaoshan Yu¹, Tao Jiang¹, Moeen Ahmed¹, Huaxi Gu¹; ¹Xidian Univ., China. This paper proposes and simulates a scalable, low-latency and high-throughput interconnect architecture (SH²IN). SH²IN is a hierarchical network with three levels. In addition, the comparisons between the SH²IN, 3D Torus, and fat tree are presented.

Su2A.70

SBS Gain Spectrum Adjustment Based on the Polarization Spreading Effect of Stimulated Brillouin Scattering in Fibers, Yunliang Han¹, Chunhua Wang¹, Yali Zhang¹, Gang Liu¹; ¹Shanghai Univ., China. An approach based on spectral polarization spreading effect of stimulated Brillouin scattering (SBS) to adjust the SBS gain spectrum is proposed. A 23.62MHz offset of SBS peak-gain position is experimentally obtained by employing a polarizer.

Su2A.71

Accuracy Evaluation of Optical-Vortex Mode Separation using Log-Polar Geometric Transformation of Amplitude Distribution, Satoru Takashima¹, Hirokazu Kobayashi¹, Katsushi Iwashita¹; ¹Kochi Univ. of Technology, Japan. We used the logarithmic polar coordinate transformation of the amplitude distribution of the light beam to perform separation for each mode of the optical vortex and evaluated it using the degree of separation.

Su2A.72

A Simplified MLSE Algorithm Based on Absolute Distance Measurement Model, Tingting Xu¹, Junqi Xia¹, Zhengxuan Li¹, Yingchun Li¹, Yingxiang Song¹, Jian Chen¹, Min Wang¹; ¹Shanghai Univ., China. We propose a simplified maximum likelihood sequence estimation based on Viterbi algorithm. Experimental results show that compared with the conventional MLSE, the proposed algorithm saves the multiplication by 25% with only ~ 0.15 dB sensitivity penalty.

Su2A.73

Mode Distribution Measurement of Optical Vortex Beam using Polarization Sagnac Interferometer with Dove Prism, Kei Nakashima¹, Hirokazu Kobayashi¹, Katsushi Iwashita¹; ¹Kochi Univ. of Technology, Japan. We study about spatial mode division multiplexing (SMDM) with optical vortex (OV) beam for increasing the capacity of optical communication. In this study, we proposed and demonstrated interferometric method to measure mode distribution of OV beam for SMDM.

Poster Session

Su2A.74

Asymmetric Resources Assignment in Software Defined Optical Network, Yuze Liu¹, Hui Li¹, Chunjian Lyu², Zhiwei Duan², Yuefeng Ji¹; ¹Beijing Advanced Innovation Center for Future Internet Technology, Beijing Univ. of Technology, Beijing, P.R.China, China; ²Beijing Key Laboratory of Network System Architecture and Convergence, Beijing Univ. of Posts and Telecommunications, China. The key idea of asymmetric modulation and spectrum assignment and asymmetric power adjustment is discussed. The asymmetric resources assignment scheme is experimentally demonstrated. It will be an effective method to reduce the resources cost in software defined optical network.

Su2A.75

Sparse Nonlinear Equalization with Match Pursuit for LED Based Visible Light Communication Systems, Guowu Zhang¹, Chao Fei², Sailing He^{1,2}, Xuezhi Hong¹; ¹ZJU-SCNU Joint Research Center of Photonics, South China Normal Univ., China; ²JORCEP, Centre for Optical and Electromagnetic Research, Zhejiang Univ., China. We propose and experimentally demonstrate sparse nonlinear equalization using match pursuit for LED based visible light communication systems. By exploring the sparsity of nonlinearity, the number of kernels is significantly reduced with the new method.

Su2A.76

Analysis of LP- and Vector Modes for the Investigation of Nonlinearities in SDM-Systems, Friederike Schmidt¹, Klaus Petermann¹; ¹Technische Universität Berlin, Germany. The analysis of space division multiplexed systems is often carried out with LP-modes, even though vector modes would possibly be more accurate. Both mode models are compared showing that the approximated LP-modes can be used for the nonlinear analysis.

Su2A.77

Real-time Demonstration of 50-Gb/s Multilane EPON for coexistence of 25G and 50G ONUs on a Single ODN, Kwang Ok Kim¹, KyeongHwan Doo¹, HanHyub Lee¹, HwanSeok Chung¹; ¹Electronics & Telecomm Res. Inst, Korea. We firstly propose and demonstrate the 50-Gb/s multilane EPON that can accommodate 25G-EPON ONU and 50G-EPON ONU in the legacy ODN.

Su2A.78

SiP-enabled FPGA Network Interface for Programmable Access to Disaggregated Data Centre Resources, Qianqiao Chen^{1,2}, Vaibhava Mishra², Peter De Dobbelaere³, Michael Enrico⁴, Nick Parsons⁴, Jose Nunez-Yanez¹, Georgios S. Zervas²; ¹Univ. of Bristol, UK; ²Univ. College London, UK; ³Luxtera Inc, USA; ⁴HUBER+SUHNER Polatis, UK. This paper demonstrates a FPGA-based network interface with reconfigurable switched ports that access to disaggregated resources. Silicon-Photonics on-board transceivers and miniaturized optical switches deliver bandwidth density and FEC-free scalability of up to 5-tier network.

Su2A.79

Photonic Intermediate Structures for Tandem Perovskite/Silicon Solar Cells, Emiliano R. Martins¹, Augusto Martins¹, Ben-Hur V. Borges¹, Juntao Li², Thomas F. Krauss³; ¹School of Engineering of São Carlos, Univ. of Sao Paulo, Brazil; ²School of Physics, State Key Laboratory of Optoelectronic Materials & Technologies, Sun Yat-sen Univ., China; ³Dept. of Physics, Univ. of York, UK. The efficiency of tandem solar cells can be boosted through photon management using intermediate photonic structures. Here, we study the impact of intermediate reflectors and optical impedance matching layers by comparing efficiency with technological complexity.

Su2A.80

Shaping the Focal Fields of Cylindrical Vector Beams, Jian Guan¹, Danyang Li¹, Jie Lin¹, Peng Jin¹; ¹Harbin Inst. of Technology, China. Two kinds of methods to shape the focal fields of cylindrical vector beams were illustrated in this work. One was based on mathematical formulations and the other was based on computerized optimizations.

Su2A.81

Highly Stretchable and Fatigue-free Transparent Electrodes Based on an In-plane Buckled Au Nanotrough Network, Siya Huang², Yuan Liu¹, Chuan Fei Guo², Zhifeng Ren¹; ¹Dept. of Physics and TcSUH, Univ. of Houston, USA; ²Dept. of Materials Science and Engineering, Southern Univ. of Science & Technology, China. A highly stretchable flexible transparent electrode based on an in-plane buckled Au nanotrough network is engineered, showing excellent stretchability (300% tensile strain) with no fatigue upon cyclic stretching to 100% strain for 100,000 cycles.

Su2A.82

Surface Plasmon Resonance Enhanced Polymer Solar Cells by Thermally Evaporating Au into Buffer Layer, Mengnan Yao¹; ¹South Univ. of Technology of China, China. We present a simple thermally evaporated technique to introduce Au NPs into the anode buffer layer of inverted PSCs to enhance light absorption by surface plasmon resonance.

Su2A.83

CdTe-ZnO Nanocrystal Solar Cells, Paul Mulvaney¹; ¹Univ. of Melbourne, Australia. The properties of CdTe-ZnO nanocrystal solar cells will be presented. We discuss the processing of both CdTe and ZnO nanocrystals and the role of doping in determining their performance as p-n junctions. We demonstrate overall solar efficiencies of 10.4% and show that a major issue is ion diffusion.

Su2A.84

Hyperelastic Optical Fiber Fabry-Perot Cavity and its Sensitivity Enhancement Property, Bin Zhou¹, Xiaolu Chen¹, Shengnan Wu², Yilong Zeng¹, Qian An¹; ¹South China Normal Univ., China; ²Zhejiang Univ., China. Optical fiber Fabry-Perot (F-P) structures with hyperelastic cavity are proposed. The cavity is filled or supported by the hyperelastic polydimethylsiloxane. The sensitivity enhancement property is analyzed and its application in magnetic field sensing is demonstrated.

Su2A.85

Widely Wavelength-Tunable Single-Longitudinal-Mode Thulium-Doped Fiber Laser Incorporating a Saturable Absorber, Yin Taoce¹, Yizhen Wei^{1,2}, Wending Mei²; ¹Centre for Optical and Electromagnetic Research, State Key Laboratory of Modern Optical Instrumentation, Zhejiang Univ., China; ²College of Communication Engineering, Hangzhou Dianzi Univ., China. We demonstrate 1870nm to 2051nm continuous wavelength-tuning in a thulium-doped fiber ring laser, using a Fabry-Perot tunable filter. By employing a saturable-absorption-induced grating filter, stable single-longitudinal-mode lasing is achieved in a range from 1920nm to 2020nm.

Su2A.86

All-fiberized master oscillator power amplifier structured narrow-linewidth 3.2ns pulsed laser with 123.2W average power and 30kW peak power, Fan Zhang^{1,2}, Xinhai Zhang¹; ¹Southern Univ. of Science and Tech, China; ²Nankai Univ., China. A 30kW peak-power and 123.2W average power linearly polarized 3.2ns all-PM-fiber amplifier is presented with 1.6MHz repetition rate. No stimulated Raman scattering is observed. And the polarization extinction ratio is 14dB.

Su2A.87

Effect of carbon nanotube fabricated by cobalt molybdenum catalyst on performance of Erbium-doped mode locked fiber laser, Chengbo Mou¹, Chuanhang Zou¹, Mohammed AlAraini^{2,3}, Qianqian Huang¹, Tianxing Wang¹, Aleksey Rozhin^{2,3}; ¹Shanghai Univ., China; ²Aston Inst. of Photonic Technologies, Aston Univ., UK; ³Nanoscience Research Group, Aston Univ., UK. We fabricated three SWCNT-PVA composite films containing more metallic carbon nanotubes with CoMoCAT for the first time and influence of these composite films on performance of an Erbium-doped mode locked fiber laser is also studied.

Su2A.88

Viscosity measurement based on acousto-optic effect on fiber Bragg grating, Heng Qian¹, Liyang Shao^{1,2}, Wending Zhang³, Xinpu Zhang¹, Haijun He¹, Xihua Zou¹; ¹Southwest Jiaotong Univ., China; ²Electrical and Electronic Engineering, Southern Univ. of Science and Technology, China; ³Northwestern Polytechnical Univ., China. A new method for viscosity measurement has been proposed based on the acousto-optic modulation on FBG. Theoretical analysis shows the bandwidth of the modulated FBG is related to the viscosity of liquid around the FBG. The experimental results show the sensitivity of the bandwidth as the viscosity increases from 1 mPa s to 5.5 mPa s.

Su2A.89

Influence of preform structure on tensile strength and attenuation of reduced diameter PANDA PMF, Feng Tu¹, Qi Qian¹, Zhongmin Yang¹, Xia Zhao², dan xu², lijuan zhang², hui zhang², xiaofei lei³, shucheng liu⁴; ¹State Key Laboratory of Luminescent Mate, China; ²Jiangsu Fasten Optoelectronics Technology Co., Ltd., China; ³School of Material Science and Engineering, Shanghai Jiaotong Univ., China; ⁴School of Material Science and Engineering, Harbin Inst. of Technology, China. With the optimization of the preform structure, the 80μm cladding diameter PMF tensile strength and attenuation could be promoted, the tensile strength test value could reach 23.62 with the attenuation <0.35dB/km @1550nm.

Su2A.90

All-fiber power combiner for coherent beam combination using large-mode-area fiber, Pengyang Shi¹, Xinhai Zhang¹; ¹South Univ. of Science and Technology, China. A 19-core signal fiber combiner is simulated for high power coherent beam combination using large-mode-area fiber. cladding/core diameter ratio η , taper ratio γ and taper length L are analyzed to find the requirements on the fabrication process for preserving beam quality of output combined beam. A 19-core fiber is tapered following the above value.

Poster Session

Su2A.91

Reducing Crosstalk of Silicon-based Optical Switch with All-optical Multi-wavelength Regenerator, Feng Wen^{1,2}, Yong Geng¹, Mingle Liao¹, Baojian Wu¹, Liangjun Lu³, Linjie Zhou³, Xingyu Zhou¹, Kun Qiu¹, Jianping Chen³; ¹UESTC, China; ²Aston Univ., UK; ³Shanghai Jiao Tong Univ., China. Improving crosstalk performance of Mach-Zehnder-interferometer-type optical switches is experimentally investigated by use of an all-optical multi-wavelength regenerator. Extinction ratio and bit error rate of WDM signals are simultaneously improved in proposed regenerative optical switching.

Su2A.92

Experimental and Theoretical Investigation of Polymer Optical Fiber Random Laser in the Weakly Scattering Regime, Jijun He¹, Wing-Kin E. Chan², Xin Chen¹, Hwa-yaw Tam¹; ¹Dept. of Electrical Engineering, The Hong Kong Polytechnic Univ., China; ²Dept. of Physics, Hong Kong Baptist Univ., China. A coherent polymer optical fiber random laser (doped with TiO₂ and fluorescent dye) in the weakly scattering regime is demonstrated. Moreover, we built a numerical model based on Monte Carlo method to describe experiment observation.

Su2A.93

Mechanical Performance Tracking of Fresh Optical Fibres with Different Coating, Liyan Zhang^{1,2}, Jing Li^{1,2}, Jianbin Duan^{1,2}, Changfeng Yan^{1,2}, Lu Liu^{1,2}, Kui Chen^{1,2}, Wenli Xiao^{1,2}; ¹State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China; ²Yangtze Optical Fibre and Cable Joint Stock Limited Company, China. We tracked the mechanical performance of fresh optical fibres with different coating for several months. Tensile strength and n_d were tested continuously. Coating performance like strip force, pull-out force and in-situ modulus were also studied.

Su2A.94

Switchable dual-wavelength mode-locked cylindrical vector beam fiber laser, Yu Cai¹, Zuxing Zhang¹; ¹Nanjing Univ of Posts and Telecommun, China. We demonstrate switchable dual-wavelength CVB generation from a passively mode-locked fiber laser using carbon nanotubes (CNTs) as saturable absorber for mode-locking and a mode-selective coupler (MSC) as both mode converter and birefringence filter.

Su2A.95

An asymmetric fiber for MIMO-free mode division multiplexing transmission, Lipeng Feng¹, Yan Li¹, Xinglin Zeng¹, Wei Li¹, jifang Qiu¹, Xiaobin Hong¹, Yong Zuo¹, Hongxiang Guo¹, Jian Wu¹; ¹Beijing Univ. of Posts and telecom, China. A six mode asymmetric fiber (AF) for MIMO-free MDM is proposed by inducing two inner-cores in the fiber core. Simulation results show that the mode correlation coefficient between AF and circle core fiber is higher than 95% for all the six modes with effective index differences no less than 3.8×10^{-4} .

Su2A.96

A Mode Selective Switch Based on Tapered Fiber and Blazed Grating, Xiaotong X. Fu¹, Li Gao¹, Mingying Lan¹, Shanyong Cai¹, Song Yu¹; ¹Beijing Univ. of Posts and Telecomm, China. This paper proposes a mode selective switch (MSS) based on tapered fiber and spatial light modulator (SLM). The MSS separates LP01 mode and LP11 mode without conversion and makes them couple to two different fibers.

Su2A.97

Bent Inline Fiber Mach-Zehnder Interferometer Used for Refractive Index Sensing, Fangda Yu¹, Chuanxin Teng², Peng Xue¹, Jie Zheng¹; ¹Jilin Univ., China; ²Guilin Univ. of Electronics Technology, China. An inline fiber Mach-Zehnder interferometer was fabricated by fusion splicer used for refractive index (RI) sensing was investigated. The result showed that bending the interferometer could enhance its RI sensitivity, and as the curvature radius decreased, the RI sensitivity reached to 196.99 nm/RIU.

Su2A.98

Ultrasensitive Magnetic Field Sensing Based on Single-mode-Tapered Two-mode-Single-mode Fiber Structures, Fang Fang¹, Bing Sun¹, Zuxing Zhang¹, Jing Xu³, Lin Zhang²; ¹Nanjing Univ. of Posts and Telecomm, China; ²Aston Inst. of Photonic Technologies, Aston Univ., UK; ³Optical Communications Laboratory, Ocean College, Zhejiang Univ., China. An optical fiber magnetic field sensor based on the single-mode-tapered two-mode-single-mode (STS) structure and magnetic fluid (MF) is proposed and demonstrated. The transmission response of the interference maxima exhibits a sensitivity of 0.671 dB/Oe.

Su2A.99

Temperature-insensitive Refractive Index Sensing Based on W-type Fiber Grating, Junjie Xie¹, Binbin Yan¹, Yanhua Luo³, Haifeng Qi⁴, Liwei Yang², Kuiru Wang¹, Chongxiu Yu¹, Xinzhu Sang¹, Yuan Jinhui¹, Chang Wang⁴, Gangding Peng³; ¹Beijing Univ. of Posts and Telecomm., China; ²China Agricultural Univ., China; ³School of Electrical Engineering, Univ. of New South Wales, Australia; ⁴Laser Inst. of Shandong Academy of Sciences, China. A temperature-insensitive refractive index sensing based on W-type fiber grating has been proposed. We investigated the response of grating and found the intensity of resonant peaks was sensitive to refractive index and insensitive to temperature.

Su2A.100

The effect of Al₂O₃ films on the mechanical properties of optical fiber based on atomic layer deposition, Yan Wu¹, Yana Shang¹, Fufei Pang¹, Yanan Kang¹, Jianxiang Wen¹, Zhenyi Chen¹, Tingyun Wang¹; ¹Shanghai Univ., China. Mechanical properties of single mode fiber deposited with Al₂O₃ films by atomic layer deposition technique are investigated. Compared with bare optical fibers, tensile strength of the fibers with Al₂O₃ film increase evidently.

Su2A.101

Static Fatigue Parameter Measurement of Optical Fibre Based on Uniform Bending, Liyan Zhang^{1,2}, Jing Li^{1,2}, Changfeng Yan^{1,2}, Lu Liu^{1,2}, Zhixiong He^{1,2}; ¹State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China; ²Yangtze Optical Fibre and Cable Joint Stock Limited Company, China. Static fatigue parameter of optical fibre was tested by uniform bending method. Influence factors like winding force and gauge length were studied. Fatigue parameters obtained by different measurement techniques were compared.

Su2A.102

Various Square-wave Pulses Generation in a Passive Mode-locked Fiber Laser, Wanzhuo Ma¹, Tianshu Wang¹, Jing Zhang¹, Qingchao Su¹, Qingsong Jia¹, Huilin Jiang¹; ¹Changchun Univ. of Science and Technology, China. The square-wave pulses in passive mode-locked fiber laser present noise-like feature at both normal square-wave state and step-like square-wave state with nanosecond level. Both the two pulses can stably operate at single-pulse and dual-pulse state.

Su2A.103

10 μJ square-wave pulses generation from a passively mode-locked figure-of-eight fiber laser, Georges Semaan¹, yichang meng², Fatma Ben Braham¹, Mohamed Salhi¹, François Sanchez¹; ¹Laboratoire de Photonique d'Angers, France; ²School of Sciences, Hebei Univ. of Science and Technology, 050018 Shijiazhuang, China, China. We report the generation of square pulses operating in dissipative soliton resonance region from a dual-amplifier figure-of-eight fiber laser. Pulses with tunable width in a range of 360 ns and energy up to 10 μJ are obtained.

Su2A.104

Long Period Fiber Grating around the Dispersion Turning Point Fabricated with a Femtosecond Laser, Fangcheng Shen¹, Kaiming Zhou^{2,3}, Lin Zhang², Xuewen Shu¹; ¹Huazhong Univ. of Science and Tech, China; ²Aston Inst. of Photonic Technologies, Aston Univ., UK; ³Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China. Long period fiber grating around the dispersion turning point, which exhibits high sensitivity to measurands such as temperature and refractive index, is fabricated in single mode fiber with a femtosecond laser for the first time.

Su2A.105

Full-vector field coupling and its intrinsic polarization-dependent and -isolated features in optical fibers, Liang Fang¹, Jian Wang¹; ¹Wuhan National Lab for Optoelectronics, China. We investigate both fiber directional and grating-assisted full-vector coupling, and find its intrinsic polarization-dependent and -isolated features. Our discovery may provide significant guidance on exploiting new fiber-based passive elements to manage modal polarization vector.

Su2A.106

Numerical study on the beam quality of the transverse mode of the thermally-guided very-large-mode-area fiber, Wenbo Liu¹, Jianqiu Cao¹, Jinbao Chen¹; ¹National Univ of Defense Technology, China. The beam qualities of transverse modes in the thermally-guiding very-large-mode-area fiber are numerically investigated. Their variations with the thermal load are given.

Su2A.107

Non-linear optical properties of carbon nanotube-coated optical fiber gratings, Fang Wang¹, Yang Zhang¹, Zhihui Duan¹, ZeXu Liu¹, Jie Han¹, Huizhen Yuan¹, Changsen Sun¹, Wei Peng¹; ¹Dalian Univ. of Technology, China. We fully investigate a nonlinear device based on a tilted fiber Bragg grating (TFBG) coated with single-walled carbon nanotubes (SWCNTs). The signal noise to ratio (SNR) of the FWM is up to 10.11dB.

Su2A.108

Frequency Response of Directly Modulated III-nitride Based Blue Laser Diode at Different Temperature, Bin Xue^{1,2}, Zhe Liu^{2,3}, Jie Yang^{1,2}, Liangsen Feng^{1,2}, Ning Zhang^{2,3}, Junxi Wang^{2,3}, Jinmin Li^{2,3}; ¹College of Materials Sciences and Opto-Electronic Technology, Univ. of Chinese Academy of Sciences, China; ²Inst. of Semiconductors, Chinese Academy of Sciences, China; ³Beijing Engineering Research Center for the 3rd Generation Semiconductor Materials and Applications, China. Frequency response of a blue laser diode was measured within a temperature range between 10 to 40 degree. -3dB bandwidth of the device exceeded 1GHz above threshold. Smaller injection current was needed to reach the same bandwidth at lower temperature.

Poster Session

Su2A.109

Anti-Occlusion Indoor Visible Light Communication System Based on Physical-Layer Network Coding, Peixuan He¹, Zhitong Huang¹, Fancheng Wang¹, Yuefeng Ji¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China. We propose an anti-occlusion indoor visible light system which utilizes the physical-layer network coding (PNC) as relay scheme. Comparing with traditional relay scheme, the PNC relay scheme improves the throughput rate by 50%.

Su2A.110

Hybrid C&C-DMA Scheme For Multi-User Access in Large-Scale VLC Network, Minglei Huang¹, Zhitong Huang¹, Yu Xiao¹, Yuefeng Ji¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China. We propose a multi-user access scheme based on Color-code division multiple access (C&C-DMA) in VLC network. The experiment shows BERs of four users under one color channel are below 3.8×10^{-3} when total data rate is 32Mbps by adopting conversed Walsh code and RGB LED.

Su2A.111

Low Threshold Single-Mode 780nm Surface Grating DFB Lasers for Atomic Clocks, Pengfei Zhang¹, Qiaoyin Lu¹, Weihua Guo¹; ¹Wuhan National Lab for Optoelectronics, China. We present a low threshold single-mode 780nm surface-grating DFB laser. The index-coupled surface-grating yields a coupling coefficient $\sim 1000\text{cm}^{-1}$. The designed 50 μm -long laser exhibits a threshold current of 0.4mA and a high slope efficiency of 0.45mW/ma.

Su2A.112

A novel single-composition trichromatic white-light $\text{Li}_2\text{BaSiO}_4:\text{Ce}^{3+}$, Eu^{2+} , Sm^{3+} phosphor via dual energy transfers, Ying Wan¹, Yusufu Taximaiti^{1,2}, Sujian Niu¹, Sidike Aierken^{1,2}; ¹Xinjiang Normal Univ., China; ²Key Laboratory of mineral luminescent material and microstructure of Xinjiang, Urumqi 830054, Xinjiang, China, China. A series of single-phased $\text{Li}_2\text{BaSiO}_4:\text{Ce}^{3+}$, Eu^{2+} , Sm^{3+} phosphors were synthesized, investigated the luminescent properties and discussed the energy transfer process. These results indicated that this phosphor has a potential application for ultraviolet white light-emitting diodes.

Su2A.113

Mechanism of Formation of Two-photon Absorption Related Filaments in Eu^{3+} Ion Doped Material, Ning-Ning Tao¹, Yan-Hua Yao¹, Nan-Nan Zhang¹, Qiao-Feng Dai¹, Hai-Ying Liu¹, Xia Wan¹, Hai-Hua Fan¹; ¹South China Normal Univ., China. A series stable solitonlike filaments were observed in Eu^{3+} ions doped glass. The experimental and theoretical results reveal that the balance between the nonlinear effects can help light wave to form this filaments

Su2A.114

The design of tunnel lighting, Xiaoping Shao¹, Min Wang¹, Qun Zhou¹; ¹Fujian normal Univ., China. We design tunnel lighting according to the requirements of People's Republic of China industry standard "code for design of ventilation and lighting for highway tunnels", which will provide certain reference value for highway tunnel construction.

Su2A.115

A Fully Digital Low-noise and High-stability Diode Laser Current and Temperature Controller, Wei Quan¹, Zhenyu Huang¹; ¹Beihang Univ., China. We present a fully digital diode laser current and temperature controller which features low noise, excellent long-term stability. The various techniques that have been applied to achieve these goals are reviewed in this work.

Su2A.116

Micro-Raman scattering and Time Resolved Luminescence of InGaN thin films grown on GaN/sapphire by MOCVD, Chong Chen^{1,2}, Deng Xie^{1,3}, Hailong Wang^{1,2}, Zhiren Qiu^{1,3}, Hao Jiang^{1,2}, Jinyu Li^{1,3}, Yuhao Ren^{1,3}, Hai Zhu^{1,3}; ¹State Key Laboratory of Optoelectronic Materials and Technologies, China; ²School of Electronics Information Technology, Sun Yat-Sen Univ., China; ³School of Physics, Sun Yat-Sen Univ., China. Indium cluster in InGaN epilayers prepared with different H_2 -treating times was investigated. In cluster with the form of lower atom bonds was evidenced by Raman spectra. Carrier lifetime was found to increase with the H_2 -treating time.

Su2A.117

Multi-Spectrum Analysis of Growth Temperature Dependent Crystal Structure of MgZnO Thin Films Grown on Sapphire, Deng Xie^{1,2}, Chong Chen^{1,3}, Zhiren Qiu^{1,2}, Hao Jiang^{1,3}, Dong-Sing Wu⁴, Zhe Chuan Feng⁵; ¹State Key Laboratory of Optoelectronic Materials and Technologies, China; ²School of Physics, Sun Yat-Sen Univ., China; ³School of Electronics Information Technology, Sun Yat-Sen Univ., China; ⁴Dept. of Materials Science and Engineering, National Chung Hsing Univ., China; ⁵College of Physics Science & Technology, GXU-NAOC center for Astrophysics & Space Science, Laboratory of Optoelectronic Materials & Detection Technology, Guangxi Univ., China. $\text{Mg}_{0.06}\text{Zn}_{0.94}\text{O}$ films are epitaxially grown at 350 to 650°C. Depolarization effect was found occurs at ~ 390 nm, while the thickness non-uniformity increases with growth temperature, ascribed to increased Mg incorporation into hexagonal ZnO phase.

Su2A.118

A Vibration Modulation Method for Natural Frequency of External-cavity Diode Laser Measurement and Laser Frequency Locking, Sizhe Liu¹, Wei Quan¹, Yueyang Zhai¹, Xiaoli Zhang¹, Qinghua Wang¹; ¹Science and Technology on Inertia Laboratory, and Opto-Electronics Engineering, Beihang Univ., China. We introduce and investigate a vibration modulation method for diode laser natural frequency measurement. The detuning power spectrum of the Fabry-Perot resonator is studied. Our experimental results and mode analysis agree well.

Su2A.119

Arbitrary Laser Frequency Stabilization Using An F-P Transfer Cavity, Xinyi Li¹, Wei Quan¹, Yueyang Zhai¹, Qinghua Wang¹, Zishan Fang¹; ¹Beihang Univ., China. We propose a method of laser frequency stabilization by using a Fabry-Perot cavity to bridge the frequency gap between the reference and the target laser frequency. The results show the transfer-cavity technique feasible and effective.

Su2A.120

Improvement of GaN-Based Light-Emitting Diodes via Optimizing the Growth Parameters of AlN/GaN Distributed Bragg Reflectors on Si(111) Substrates, Yibin Yang¹, BaiJun zhang²; ¹Guangdong Univ. of Technology, China; ²Sun Yat-sen Univ., China. Growth parameters of AlN/GaN DBRs on Si grown by MOCVD are optimized, leading to a high peak reflectivity of the DBR stopband and a light output improvement of 41% of the optimal AlN/GaN DBR-based LEDs.

Su2A.121

Active Low Insertion loss TE Pass Polarizer, Yipeng Song¹, Xu Peipeng¹; ¹Ningbo Univ., China. We numerically demonstrated an active polarizer based on GST-assisted hybrid waveguide. A high extinction ratio has been achieved with the ultra-low insertion loss with GST in crystalline phase. When trigger to the amorphous phase, the device exhibits transparent with the negligible insertion loss for TE/TM mode.

Su2A.122

Nonlinear Distortion Suppression in a Hybrid Integrated Dual-Parallel Modulated DFB Laser, Yunshan Zhang^{1,4}, Guowang Zhao², Yuechun Shi², Lianyan Li¹, Jilin Zheng³, Linjie Zou², Yuke Zhou², Hui Zou¹, Jianping Shen¹, Xiangfei Chen²; ¹Njupt, China; ²Nanjing Univ., China; ³PLA Univ. of Science and Technology, China; ⁴High-Tech Inst. of Nanjing Univ. (Suzhou), China. The hybrid integrated dual-parallel modulated DFB laser is designed and fabricated to suppress the nonlinear distortion. A reduction of about 7.4 dB of the third-order intermodulation distortion (IMD3) and an increase of 5 dB of the spurious free dynamic range (SFDR) compared to the single DFB laser are achieved.

Su2A.123

Design and Optimization of Photodetector Array Electrodes, Kang Zhao¹, Yongqing Huang¹, Jiarui Fei¹, Xiaofeng Duan¹, Kai Liu¹, Xiaomin Ren¹; ¹Beijing Univ. of Posts and Telecommunications, China. A high-speed, low-loss electrodes applied to photodetector array (PDA) was designed and optimized by using simulating software HFSS. The designed electrodes were fabricated and tested. Compared with the electrodes before optimization, the insert loss decreased by 1.1dB at 40GHz and the bandwidth increased by 8GHz.

Su2A.124

Generations of multiple orbital angular momentum modes in 2D nonlinear photonic crystal, Dan Wei¹, Jiale Guo¹, Xinyuan Fang¹, Dunzhao Wei¹, Rui Ni¹, Peng Chen¹, Xiaopeng Hu¹, Yong Zhang¹, Wei Hu¹, Yanqing Lu¹, Shining Zhu¹, Min Xiao¹; ¹Nanjing Univ., China. We experimentally generate multiple orbital angular momentum (OAM) modes with different color in 2D nonlinear photonic crystal. The process is achieved by the cascaded third-harmonic generation using the non-collinear quasi-phase-matching technique.

Su2A.125

Any bias point control scheme for Mach-Zehnder modulator based on phase dithering, Xueguang Yuan¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China. A bias control scheme for the Mach-Zehnder modulator based on phase dithering is proposed. The output optical average power are used as feedback signal. This technique can realize any bias point control for MZ modulator. Its effectiveness is demonstrated with experiments.

Su2A.126

Mode Conversion Based on Genetic Algorithm for Mode Division Multiplexing Systems, Zhimin Xi¹, Li Gao², Shanyong Cai³, Song Yu³; ¹Inst. of Educational Technology, Beijing Univ. of Posts and Telecommunications, China; ²School of Digital Media and Design Arts, Beijing Univ. of Posts and Telecommunications, China; ³State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China. The phase mask optimized by the genetic algorithm loaded on the spatial light modulator for mode conversion is proposed. Simulation results demonstrate that modes are accurately excited with the correlation coefficient greater than 0.99.

Poster Session

Su2A.127

Analysis of Dynamic Common Mode Rejection Ratio of Balanced Uni-Traveling-Carrier Photodetectors, Yaru Han¹, Bing Xiong¹, Changzheng Sun¹, Yi Luo¹, Zhibiao Hao¹, Jian Wang¹, Yanjun Han¹, Lai Wang¹, Hongtao Li¹; ¹*Tsinghua Univ., China*. The parameters affecting both static and dynamic common mode rejection ratio (CMRR) performance of balanced uni-traveling-carrier photodetectors have been investigated. The differences in device sizes and ohmic contact are the key parameters on the CMRR.

Su2A.128

Brillouin assisted optical frequency comb generation using the dual-mode square microlaser as seeding source, Hai-Zhong Weng¹, Yong-Zhen Huang¹, Yue-De Yang¹, Jin-Long Xiao¹, Jun-Yuan Han¹, Ming-Long Liao¹; ¹*Inst Semiconductor, CAS, China*. We demonstrate the optical frequency comb generation using the dual-mode square microlaser as a seeding source under four-wave-mixing and stimulated Brillouin scattering effects. A frequency comb with 130 nm range and 76.3 GHz repetition rate is achieved.

Su2A.129

Flexible visible photonic crystal defect cavity for nanoscale strain sensors, Jie Zhou^{1,2}, Taojie Zhou², Jiagen Li², Kebo He², Zhiren Qiu³, Bocang Qiu^{4,5}, Qian Li¹, Zhaoyu Zhang²; ¹*School of Electronic and Computer Engineering, Peking Univ., China*; ²*School of Science and Engineering, the Chinese Univ. of Hong Kong, China*; ³*State Key Laboratory of Optoelectronic Materials, Sun-Yat Sen Univ., China*; ⁴*Shenzhen Raybow Optoelectronics Corp, China*; ⁵*Research Inst. of Tsinghua Univ. in Shenzhen, China*. A L3 defect photonic crystal nanolaser embedded in flexible medium for nanoscale strain detections is proposed. Theoretical optical strain sensitivities of approximately 4.5 and 3 nm per ϵ (1% strain for both) for the x and y directions are predicted.

Su2A.130

Quasi-waveguide Tandem Multi-crystal Laser Oscillator, Yijie Shen¹, Wenqi Zhang¹, Yuan Meng¹, Mingming Nie¹, Mali Gong¹; ¹*Tsinghua Univ., China*. A new scheme of laser oscillators is proposed by utilizing quasi-waveguide tandem multi-crystal configuration. The optimized tandem four-crystal scheme can reach 72.1 W near TEM₀₀ output with the highest optical-optical efficiency of 57.0%.

Su2A.131

High-Reflectivity Broadband Mirror Based on a Two-Dimensional High-Index Contrast Grating, Shaojuan Mao¹, Yongqing Huang¹, Gang Wu¹, Xiaofeng Duan¹, Kai Liu¹, Xiaomin Ren¹; ¹*Beijing Univ. of Posts and Telecom, China*. A high-reflectivity broadband mirror using a two-dimensional grating with round rods arranged in hexagonal symmetry is investigated. The bandwidth of high reflectivity (R>95%) is ~225 nm for TM and TE modes, ranging from 1375-1600 nm.

Su2A.132

Demonstration of on-chip tunable Fano resonance based on interference between microring resonator and Fabry-Perot cavity, Shuang Zheng¹, zhengsen ruan¹, Shengqian Gao², yun long¹, Shimao Li², Mingbo He², nan zhou¹, Jing Du¹, li shen¹, Xinlun Cai², Jian Wang¹; ¹*Wuhan National Laboratory for Optoelectr, China*; ²*Sun Yat-sen Univ., China*. Based on an on-chip coupling resonant system, we experimentally demonstrate tunable Fano resonances with maximum extinction ratio (ER) of 23.22 dB and maximum slope rate (SR) of 252 dB/nm. Moreover, the wavelength of Fano resonance can be shifted widely with a tuning efficiency of 0.2335 nm/mW.

Su2A.133

Relative Intensity Noise Characteristics of Single-mode Lasers Array under Injection Locking, Xu Ke¹, Bing Xiong¹, Changzheng Sun¹, Weichao Ma¹, Jian Wang¹, Zhibiao Hao¹, Yanjun Han¹, Lai Wang¹, Hongtao Li¹, Yi Luo¹; ¹*Tsinghua Univ., China*. Relative intensity noise (RIN) of single-mode diode laser array injection-locked by another diode laser is analyzed. The coherent combining phase has significant influence on the RIN at low frequencies, and increasing injection ratio can suppress this problem.

Su2A.134

Effect of optical pump on the dielectric properties of 0.55NdAlO₃-0.45CaTiO₃ Ceramics in terahertz range, Songjie Shi¹, furi ling³, Ying Zeng³, Jingcheng Zhang³, Quantao Yin³, Jianquan Yao²; ¹*Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China*; ²*Tianjin Univ., China*; ³*School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China*. Tuning the dielectric permittivity spectra of 0.55NdAlO₃-0.45CaTiO₃ Ceramics in an external optical field is investigated at room temperature by using terahertz time-domain spectroscopy. The tuning of the permittivity reached up to 12.7% at 0.5THz.

Su2A.135

N-port non-Blocking Optical Router for Network-on-Chip, Minming E. Geng^{1,4}, Zhenhua Tang^{1,2}, Kan Chang^{1,2}, Zhenrong Zhang^{1,3}, Jiali Zheng^{1,3}, Qiang Liu^{1,3}; ¹*School of Computer, Electronics and Information, Guangxi Univ., China*; ²*Guangxi Key Laboratory of Multimedia Communications and Network Technology (Cultivating Base), China*; ³*Key Laboratory of Multimedia Communications and Information Processing of Guangxi Higher Education Inst.s, China*; ⁴*Guangxi Experiment Center of Information Science, China*. A universal method for constructing an N-port non-blocking optical router based on 2x2 Mach-Zehnder optical switch for photonic networks-on-chip is proposed. The non-blocking property of the proposed optical router is proved.

Su2A.136

Simulation Study on the Maximum Incident Optical Intensity of Zero-Bias MUTC-PD, Jie Wu¹, Yongqing Huang¹, Jiarui Fei¹, Xiaofeng Duan¹, Kai Liu¹, Xiaomin Ren¹; ¹*Beijing Univ. of Posts and Telecommunications, China*. The 3dB-bandwidth versus incident optical intensity and saturation property of modified uni-traveling carrier photodiode (MUTC-PD) was simulated. When the optical intensity is less than 5.13×10^{15} W/cm², the MUTC-PD could maintain linear output power and its bandwidth could reach 134.8GHz at 0V.

Su2A.137

Realization of optical broadband angular selectivity by the disordered structure, Jiayang Guo¹, Shaofei Chen¹, Shaoji Jiang¹; ¹*Sun Yat-sen Univ., China*. The potential of disordered photonic structures on the broadband optical angular selectivity is proposed and verified by the transfer matrix method. Moreover, the performances of angular passband can be optimized by the multiple disordered structure.

Su2A.138

High-Q photonic crystal nanofiber cavity design and application of refractive index sensing, Hongrui Nie¹, Xin Chen¹, Xiaoxue Ma¹, Bocong Zhao¹, Daquan Yang¹; ¹*Beijing Univ. of Posts and Telecommunications, China*. We propose a one dimensional nanofiber photonic crystal dielectric mode micro-cavity with high performance, which can both achieve high sensitivity of 579.3 nm/RIU and high quality over 10⁶. Importantly, this design achieves optical coupling automatically.

Su2A.139

Efficient Silicon-on-Insulator Taper using Fast Quasiadiabatic Dynamics, Hung-Ching Chung¹, Shuo-Yen Tseng¹; ¹*Photonics, National Cheng Kung Univ., China*. We propose a 3.2-mm-long taper with width varying from 0.5 mm to 2 mm and a 64-mm-long taper with width varying from 0.5 mm to 12 mm, achieving transmissions of 99.7% and 99.6%, respectively.

Su2A.140

Broadband spectral compression assisted by soliton self-frequency shift in a chalcogenide strip waveguide, Chao Mei^{1,2}, Yuan Jinhui^{1,2}, Feng Li^{2,3}, Zhe Kang², Xianting Zhang², Yin Xu², Binbin Yan¹, Xinzhu Sang¹, Kuiru Wang¹, Chongxiu Yu¹, P. K. A. Wai^{2,3}; ¹*Beijing Univ of Posts & Telecom, China*; ²*Dept. of Electronic and Information Engineering, Hong Kong Polytechnic Univ., China*; ³*Hong Kong Polytechnic Univ. Shenzhen Research Inst., China*. We investigate broadband spectral compression assisted by soliton self-frequency shift in a proposed chalcogenide strip waveguide. Simulation results show that a compression ratio of 7.2 and a wavelength shift of 190 nm can be achieved.

Su2A.141

A Vertically Integrated Device Composed of a VCSEL and a Broadband RCE-PD, Qi Wei¹, Kai Liu¹, Huize Fan¹, Yongqing Huang¹, Qi Wang¹, Shiwei Cai¹, Tao Liu¹, Jiarui Fei¹, Xiaomin Ren¹; ¹*Beijing Univ. of Posts and Telecomm., China*. A VCSEL and a Resonant Cavity Enhancement Photodiode are vertically integrated and can be functionally optical decoupled and electrical isolation. The threshold current of VCSEL is 1.67 mA, and FWHM of RCE-PD is 13 nm.

Su2A.142

Effect of reflector structure on the maximum power intensity of the focal point of the SWG focusing reflector, Gongqing Li¹, Xiaofeng Duan¹, Shuai Zhang¹, Kun Zeng¹, Shuo Wang¹, Xiaokai Ma¹, Yongqing Huang¹, Kai Liu¹, Xiaomin Ren¹; ¹*State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China*. By simulating one-dimensional SWG focusing reflectors with different structures, a detailed investigation of the effect of reflector focal length and width on maximum power intensity of the focal point has been presented.

Su2A.143

Reducing light reflection of CIGS solar cells with double Au nanoparticle layer structures, Zeyuan Yang¹, Jun Wang¹, Zhuo Cheng¹, Haiyang Hu¹, Yibing Fan¹, Xing Ma¹, Yongqing Huang¹, Xiaomin Ren¹; ¹*Beijing Univ. of Posts and Telecomm, China*. Anti-reflection coatings (ARCs) with double layers of Au nanoparticles for CIGS solar cells were proposed. The ARC's structure parameters were optimized to reduce the reflectivity by 82% compared to the case of no ARCs.

Su2A.144

Inverse Design of Nanostructured Waveguide Bends with Ultra-small Radii, Yingjie Liu¹, Lu Liu¹, Yongqiang Xie¹, Ke Xu¹; ¹*Harbin Inst. of Technology (Shenzhen, China)*. The nanostructured waveguide bends with ultra-small bending radii are inversely designed by a fast search algorithm. The transmission efficiencies of all the designed bends are above ~80% for TE polarization near 1550nm wavelength.

Poster Session

Su2A.145

Metamaterial Perfect Absorber at Visible-near Infrared Frequencies Using Metal-dielectric-metal Structure, Peixiang Wang¹, Shaowu Wang¹, Tao Wu¹, Xiaoping Li¹, Jianjun Lai¹; ¹Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China. A ultra-broadband polarization-independent nearly perfect absorber at visible-near infrared frequencies has been proposed. The absorber bases on a metal-dielectric-metal(MDM) structure. Extraordinary optical absorption with absorption peaks up to 99% can be achieved.

Su2A.146

A double metasurface filter-lenses for visible region, Shaowu Wang¹, Jianjun Lai¹, Junqiang Sun¹; ¹Wuhan National Lab. for Optoelectronics, China. We present an optical filter-lenses based on the double metasurface structures. The filter-lenses is designed with high transmittance, diffraction efficiency and numerical aperture. Both filtering and focusing functions can be realized by the designed structure.

Su2A.147

Design of Integrated Orbital Angular Momentum (OAM) Emitter Based on AlGaInAs/InP Epitaxial Wafer, Juan Zhang¹, Changzheng Sun¹, Bing Xiong¹, Jian Wang¹, Zhibiao Hao¹, Lai Wang¹, Yanjun Han¹, Hongtao Li¹, Yi Luo¹; ¹Electronic Engineering, Tsinghua Univ., China. A novel orbital angular momentum (OAM) emitter based on AlGaInAs/InP epitaxial wafer for monolithic integration with semiconductor laser is proposed. Simulated transmission/emission spectra and emission patterns are presented to illustrate the performance of the device.

Su2A.148

Polarization Insensitive Beam Splitter With Focusing Ability Using 2D High Index Contrast Gratings, Wenjing Fang², Xia Zhang², Xinye Fan², Yongqing Huang¹, Ying Wang¹, Jiarui Fei¹, Chenglin Bai²; ¹BUCT, China; ²Shandong Provincial Key Laboratory of Optical Communication Science and Technology, School of Physical Science and Information Technology, Liaocheng Univ., China. A polarization-insensitive 2D high index contrast gratings (HCGs) beam splitter based on silicon-on-insulator(SOI) is proposed and demonstrated, which performs two independent functions: transmission focusing and power equalization at the wavelength of 1550 nm.

Su2A.149

Ultra-wide asymmetric optical transmission over 1.3-1.5 μm optical communication band based on non-parallel dual gratings, Jing Luan¹, Yonghong Ling¹, Tongjun Liu¹, Wenbing Liu¹, Lirong Huang¹; ¹Huazhong Univ. of science and technology, Wuhan National Laboratory for Optoelectronics & School of Optical and Electronic Information, China. We propose an asymmetric transmission device based on two non-parallel gratings made of Si and Au, which shows wide-angle and high contrast ratio asymmetric transmission over ultra-wide spectral range covering 1.3-1.5 μm optical communication band.

Su2A.150

Dynamic Tunable Phase-Shift Mechanism Based on Plasmon Induced Transparency in Two Stub Resonators Side-Coupled with a Waveguide System, Boyun Wang¹, Qingdong Zeng¹, Shuyuan Xiao², Liangbin Xiong¹, Jun Du¹, Huaqing Yu¹; ¹Hubei Engineering Univ., China; ²Wuhan National Laboratory for Optoelectronics, China. We theoretically and numerically investigate a dynamic tunable phase-shift mechanism based on plasmon induced transparency (PIT) in two stub resonators side coupled with a metal-dielectric-metal plasmonic waveguide system through the optical Kerr effect modulation method.

Su2A.151

The Graphene-based Ring Resonator, Feng Zhou¹, Huajiang Wen¹, Xiaofeng Jin¹; ¹Univ., China. It is demonstrated a ring resonator optical modulator based on graphene-silicon-waveguide. By applying bias voltage on the graphene, the resonance wavelength will be varied accordingly, providing an easy way to achieve light modulation.

Su2A.152

Controlling Fano resonances in photonic crystal nanobeams side-coupled with nanobeam cavities, Ziming Meng¹; ¹Guangdong Univ. of Technology, China. In this paper, we numerically study asymmetric Fano line shape realized in a photonic crystal nanobeam (PCN) side-coupled with a photonic crystal nanobeam cavity (PCNC). The Fano resonances can be controlled by the photonic band gap of the PCN. If changing the symmetry of cavity mode, the Fano line shape can also be changed correspondingly.

Su2A.153

A novel method to calculate the hologram in optical communication application, Wei-Bin Hong¹, Xiang-Yang Yu¹; ¹Sun Yat-Sen Univ., China. We propose a more simple and flexible method to calculate the hologram based on the modulation of the spectrum intensity distribution. With this method, the hologram can achieve different functions in optical communication.

Su2A.154

Ultrasmall Channel Drop Filter Using Width-Tuned Waveguide on Two-Dimensional Photonic Crystal Slab, Yu Y. Zhuang¹, Heming Chen¹, Ke Ji¹, Yuchen Hu¹; ¹Nanjing Univ. of Posts & Telecom, China. We propose an ultrasmall channel drop filter using width-tuned waveguide based on photonic crystals. An one-side width-tuned waveguide is introduced to improve the performance of the filter, which is proved by theoretical analysis and simulations.

Su2A.155

High Efficiency Graphene Phase Modulator Based on Silicon Spiral Waveguide, Haowen Shu¹, Zhennan Wu¹, Yan Li¹, Xingjun Wang¹, Yanping Li¹, Zhiping Zhou¹; ¹Peking Univ., China. A novel graphene phase modulator based on silicon spiral waveguide is designed with high efficiency. A $\pi/3$ phase shift can be achieved with the voltage range of (1.1~2.3) V within a ultra-compact interaction size (32.25 x 32.25) μm^2 .

Su2A.156

Large angular spin splitting of Gaussian beams in an anisotropic metamaterial, Wenguo Zhu¹; ¹Jinan University, China. An angular spin splitting is theoretically investigated when a linearly polarized Gaussian beam is transmitted through an anisotropic metamaterial. And its upper limit is found to be the divergence angle of incident Gaussian beam.

Su2A.157

Impact of short channel effects on detection of terahertz radiation in silicon nanowire MOSFETs, Guangjin Ma^{1,2}, Guoqing Hu^{1,2}, Chunlai Li², Ying Yu², Zhiping Zhou^{1,2}, Jin He^{1,2}; ¹School of Electronics Engineering and Computer Science, Peking Univ., China; ²Shenzhen SoC Key Laboratory, PKU-HKUST Shenzhen-Hong Kong Institution, China. Characteristic especially geometrical parameters have been investigated for the detection of terahertz radiation by plasma waves in silicon nanowire MOSFETs. Results will guide towards optimum design of a terahertz detector.

Su2A.158

High-efficiency Nd:YAG 1061 nm, 1064 nm dual wavelength laser at room temperature operation, Chen Zhao¹, Ji Xia¹, Yin F. Wang¹, Zhong X. Wang², Hong Luo¹, Dong S. Xiong¹; ¹National Univ. of Defense Technology, China; ²Xiamen Univ., China. We propose and demonstrate a 1061- and 1064-nm dual-wavelength Nd:YAG laser by exploiting a dielectric Fabry-Perot band-pass filter (FPF) as laser output mirror. Simultaneous dual-wavelength lasing at 1061-nm and 1064-nm is successfully achieved at room temperature.

Su2A.159

Mode and Loss Analysis of a Graded Si_{1-x}Ge_x Strip Waveguide, Darpan Mishra¹, Ramesh K. Sonkar¹; ¹Electronics and Electrical Engineering, Indian Inst. of Technology Guwahati, India. In this paper, the quasi-vectorial mode and loss characteristics of a graded Si_{1-x}Ge_x strip waveguide have been calculated for Coarse Wavelength Division Multiplexing (CWDM) wavelengths.

Su2A.160

Optimization of InAs/InGaAs quantum-dot microdisk lasers directly grown on silicon, Wei Wang¹, Jun Wang¹, Zhuo Cheng¹, Xing Ma¹, Haiyang Hu¹, Ran Zhang¹, Zeyuan Yang¹, Yibing Fan¹, Haiying Yin¹, Yongqing Huang¹, Xiaomin Ren¹; ¹Beijing Univ. of Posts and Telecomm, China. We demonstrate firstly an optimized InAs/InGaAs quantum-dot microdisk laser structure on silicon. The simulations indicate that Q-factor can exceed 10⁶ at wavelength of 1.3μm with the diameter and the cladding layer thickness of 7μm and 1.75μm.

Su2A.161

Efficient absorption by monolayer graphene in Au slot waveguide, Ziyu Liu¹; ¹China Academy of Space Technology (CAST), China. We demonstrate a graphene photodetector based on Au slot waveguide. The absorption of the graphene was enhanced by the resonating, so to improve the detection efficiency and the size of the device reduced. The broadband response shows the potential on general photo detector on chip.

Su2A.162

Withdrawn.

Su2A.163

A novel graphene/MoS₂ heterojunction as broadband infrared photodetector, Jia Yang¹; ¹electrical and electronic engineering, Southern Univ. of Science and Technology of China, China. Photodetectors with excellent detecting properties over a broad spectral range have wide application in many optoelectronic devices.

Poster Session

Su2A.164

Revealing the Mechanism of Photoluminescence from Single Gold Nanospheres, Zhang Fanwei¹, Li Tao¹, Wu Lijun¹; ¹South China Normal Univ., China. Using defocused imaging technique, we investigate the photoluminescence (PL) properties of gold nanospheres on a single-particle level. Photo-blinking and photo-bleaching phenomena are both observed, similar to that reported previously for gold nanoclusters (~2 nm).

Su2A.165

Passive Q-switched Mode-locking of Tm,Ho:LiLuF₄ Laser with a WS₂ Saturable Absorber, Ke Li¹, Liangfang You¹, Zhong Dong¹, WeiJun Ling¹; ¹Inst. of laser technology, Tianshui Normal Univ., China. A passively Q-switched mode-locked Tm,Ho:LiLuF₄ laser using few-layer WS₂ as a saturable absorber is demonstrated for the first time. Results show that WS₂ is a promising saturable absorber for QML in 2 μm wavelength.

Su2A.166

Optical Properties of ZnO Nanowires in the Terahertz Frequency Regime, Qijun Liang¹; ¹Qian Xuesen Laboratory of Space Technology, China Academy of Space Technology, China. We demonstrate the complex conductivity of ZnO nanowires using terahertz time-domain spectroscopy. The influences of annealing atmosphere to terahertz properties of ZnO nanowires are investigated by fitting the experimental data with the Drude-Smith model.

Su2A.167

Single and Two-photon Absorption Single-microbelt Photodetector, Guanlin Lou,¹ Hai Zhu,^{1,*} Anqi Chen,¹ Yanyan Wu,¹ Zhiyang Chen,¹ Yuhao Ren,¹ Yunfeng Liang,¹ Jinyu Li,¹ Xuchun Gui,² Dingyong Zhong,¹ Zhiren Qiu¹ and Zikang Tang^{2,3}; ¹State Key Laboratory of Optoelectronic Materials and Technologies, School of Physics, Sun Yat-Sen Univ., China; ²State Key Laboratory of Optoelectronic Materials and Technologies, School of Electronics and Information Technology, Sun Yat-Sen Univ., China; ³The Inst. of Applied Physics and Materials Engineering, Univ. of Macau, Avenida da Universidade, China. Single microbelt photodetectors have been demonstrated and characterized comprehensively. For single-photon absorption, the maximum responsivity of ZnO-MB photodetector can reach as high as 1.4×10^5 A/W at 20 V bias. The two-photon absorption upconversion photoresponsivity in the single-MB detector has also been realized.

Su2A.168

Active modulation of electromagnetically induced transparency analogue with monolayer graphene in terahertz metamaterials, Shuyuan Xiao¹, Tao Wang¹, Tingting Liu², Xicheng Yan¹, Zhong Li³, Chen Xu⁴; ¹Wuhan National Lab for Optoelectronics, Huazhong Univ. of Science and Technology, China; ²School of Electronic Information and Communications, Huazhong Univ. of Science and Technology, China; ³Dept. of Physics and Astronomy, The Univ. of Alabama, USA; ⁴Dept. of Physics, New Mexico State Univ., USA. We integrate a monolayer graphene into terahertz metamaterials and realize a complete modulation in the resonance strength of electromagnetically induced transparency, where the physical mechanism lies in the recombination effect of the conductive graphene.

Su2A.169

Effects of laser micro-machining on LED's luminous performance, Qing Yun Yu¹, Wei Yi Shi¹, Xiao-Ning Pang¹, Fu-Li Zhao¹, Jian-Wen Dong¹; ¹Sun Yat-Sen Univ., China. The microstructure was fabricated on LED surface with a picosecond laser. The measurement of far field light distribution from processed LED agrees with the simulation. Such fabrication may have potential application for LED light distribution.

Su2A.170

Development of high repetition rate laser-ablation spark-induced breakdown spectroscopy and evaluation of its analytical performance, Xiaoyong He¹, Runhua Li¹, Yuqi Chen¹; ¹South China Univ Tech, China. Aim to increase imaging speed in 2D elements mapping technique under high spatial resolution, high repetition rate laser-ablation spark-induced breakdown spectroscopy was developed and its analytical performance on elemental analysis of aluminum alloys was evaluated.

Su2A.171

Uniform, high-spatial-frequency ripples generated on ferric ion-doped poly(N-vinylpyrrolidone) film using a femtosecond laser at high repetition rate, Chengcheng Guo¹; ¹South China Normal Univ., China. Uniform HSFLs with periods of 40-nm to 100-nm have been generated on ferric ion-doped poly(N-vinylpyrrolidone) films at high repetition rate femtosecond laser pulses (80 MHz, 800 nm, 130 fs). Our results show that SPPs excited in thin polymer films illustrates well the formation of nanostructures and its dynamic properties observed.

Su2A.172

Near Infrared Refractive-Index Sensing Based on a Split Ring Metasurface, Liyong Jiang¹, Xiangyin Li¹; ¹Nanjing Univ of Sci & Tech., China. We report the refractive-index sensing based on a split ring metasurface. A high sensitivity of ~900 nm/RIU in the near infrared region was demonstrated for the sample with double gaps.

Su2A.173

Tunneling Induced Nonlinear Absorption and Its Sensor Characteristics in Coupled Quantum Dots, Yandong Peng¹, Aihong Yang¹, Lei Li¹, Tingqi Ren¹; ¹Shandong Univ. of Sci and Tech, China. Tunneling-induced nonlinear absorption is investigated in coupled quantum dots. Tunneling causes constructive interference for the fifth-order nonlinearity and total absorption is enhanced dramatically. Nonlinear absorption provides sensitive detection for inter-dot tunneling.

Su2A.174

Single-crystalline ZnO microwire two-photon absorption photodetector, Zhiyang Chen¹; ¹School of Physics, State Key Laboratory of Optoelectronic Materials and Technologies, China. We presented large enhancement of degenerate two-photon absorption through hexagonal cavity resonance in single-crystalline ZnO microwire involved Fabry-Perot (FP) cavity and whispering gallery mode (WGM) cavity. We experimentally demonstrated it is feasible to fabricate degenerate two-photon absorption single microwire photodetector.

Su2A.175

Tunable terahertz beam focusing based on a graphene-covered silicon transmission grating, Jianli Jiang¹, Xiao Zhang¹, Wei Zhang¹, Shuang Liang¹, Liyong Jiang¹; ¹Physics, Nanjing Univ. of Science and Technology, China. We report a tunable terahertz beam focusing model based on a graphene-covered silicon transmission grating. Dependences of the focusing performance on the chemical potential and the scattering rate of graphene were studied and well explained.

Su2A.176

Highly-efficient milli-joule level 3.5 μm optical parametric oscillator based on MgO:PPLN, Sujian Niu¹, Palidan Aierken¹, Ying Wan¹, Yusufu Taximaiti^{1,2}; ¹Xinjiang Normal Univ., China; ²Laboratory of Novel Light Source and Micro/Nano-Optical, Xinjiang Normal Univ., Urumqi 830054, Xinjiang, China, China. We report a milli-joule level mid-infrared MgO:PPLN optical parametric oscillator. The maximum mid-infrared 3.5 μm idler output energy reached 3.47 mJ at the pump energy of 21 mJ, corresponding to a photon conversion efficiency of 55%

Su2A.177

One-dimension Random Laser based on Artificial High-index Contrast Scatterers, Yanyan Wu¹; ¹State Key Laboratory of Optoelectronic Materials and Technologies, School of Physics, Sun Yat-sen Univ., China. The realization of one-dimension random laser by using artificially fabricated scatterers in our experiment represents a novelty method towards the development of manipulated-RL, which will highlight the application of disordered system on optoelectronic devices.

Su2A.178

High Efficiency Optical Phase Control Based on Thick Metallic Nanoparticle Arrays, Xiaobin Hu^{1,2}, Tong Li^{1,2}, Jian Li^{1,2}, guofeng Song^{1,2}, Xin Wei^{1,2}; ¹Inst. of semiconductors, CAS, China; ²College of Materials Science and Opto-Electronic Technology, Univ. of Chinese Academy of Sciences, China. We theoretically demonstrate that Fabry Perot resonance with high transmission can be generated in thick metallic nanoparticle array. And high efficiency phase control can be realized by adjusting the width of the nanoparticles.

Su2A.179

Fabrication of In-situ Localized Surface Plasmon Enhancement of Au Nano-particles on Multiple Quantum Wells Nanorods, Jie y. Xing¹, Yingsong Chen¹, Xiaobiao Han¹, Yuan Ren¹, Changming Zhong¹, Hang Yang¹, Jiezhong Liang¹, Dejie Huang¹, Yaqian Hou¹, Zhisheng Wu^{1,2}, Yang Liu^{1,2}, BaiJun zhang^{1,2}; ¹Sun Yat-sen Univ., China; ²State Key Laboratory of Optoelectronic Materials and Technologies, China. With a Ni/SiO₂/Au/SiN_x compound function layer, in-situ localized surface plasmon of gold nano-particles on the top of multiple quantum wells nanorods was fabricated, whose integrated photoluminescence intensity show a 1.9-fold enhancement compared with bare nanorods.

Su2A.180

SiN-based Meta-hologram Combining Up-conversion Nanoparticles, Wen-Sheng Ruan^{1,2}, Zhi-Bin Fan^{1,2}, Xiao-Ning Pang^{1,2}, Jian-Wen Dong^{1,2}; ¹State Key Laboratory of Optoelectronic Materials and Technologies, Sun Yat-sen Univ., China; ²School of Physics, Sun Yat-sen Univ., China. We numerically design a silicon-nitride-based meta-hologram that applies up-conversion nanoparticles to convert the 980 nm near-infrared light into 550 nm visible transmission light and achieves the visible hologram reconstruction.

Poster Session

Su2A.181

Ultrathin linear polarizer based on crystalline silicon metasurfaces at visible wavelength, Qiaoling Lin¹, Zhenpeng Zhou¹, Jin Xiang², Sheng Lan², Juntao Li¹; ¹Sun Yat-sen Univ., China; ²South China Normal Univ., China. Polarization is one of the most important properties of light. Here we numerically simulate and experimentally fabricate an ultrathin linear polarizer with high transmission at visible wavelength by utilizing metasurfaces of crystalline silicon posts arrays.

Su2A.182

Highly Efficient Carrier-envelope-offset Detection of a 137fs Ti:sapphire Mode-locked Laser, Xiao Xiang¹, Ziyue Zhang², Ruifang Dong¹, Shaofeng Wang¹, Hainian Han², Tao Liu¹, Shougang Zhang¹; ¹National Time Service Center, Chinese Academy of Sciences, China; ²Inst. of Physics, Chinese Academy of Sciences, China. We firstly report the highly efficient carrier envelope offset (CEO) detection of a 137fs Fourier-transform-limited Ti:sapphire mode-locked laser. The high signal to noise ratio of the CEO beat indicates that the coherence of the supercontinuum is well retained, while the pulse soliton order completely violate the previous theoretical limitation.

Su2A.183

Laser Desorption Postionization Mass Spectrometry Imaging of Folic Acid in Tumor Tissue Sections, Qiao Lu¹, Yongjun Hu¹; ¹MOE Key laboratory of Laser Life Science & Inst. of Laser Life Science, College of Biophotonics, South China Normal Univ., China. A novel method was proposed to map the folic acid spatial distribution in tissue sections by laser desorption postionization mass spectrometry imaging. The results suggest that the method could be used potentially in cancer diagnosis.

Su2A.184

Numerical Simulation of the Process for Micro-lens Manufacturing, Huayang He¹; ¹Research Inst. of Highway, Ministry of Transport, Beijing, China, China. The collision between droplet and the substrate is the key of the biochip's micro-lens generated on needing positions. The numerical model was established to simulate the collision and the deformation of the droplet and the substrate.

Su2A.185

A novel dual-amplified SERS nanoplatform for microRNA detection with ultra-sensitivity, Ningjing Jiang¹, Yongjun Hu¹; ¹South China Normal Univ., China. Herein, we propose a novel dual-amplified nanoplatform. The SERS tags comprise the Au-Ag bimetallic plasmonic structure exhibit unique LSPR which induce the primary amplification of Raman signal and thereafter the cyclic system amplified signals ulteriorly.

Su2A.186

Powerful Explosions of Gold Nanorods to Destroy Cancer Cells by Using Plasmonic Coupling, Yan-Hua Yao¹, Nan-Nan Zhang¹, Ning-Ning Tao¹, Qiao-Feng Dai¹, Hai-Ying Liu¹, Hong-Mei Li², Yin-Yin Li², Hai-Hua Fan¹; ¹South China Normal Univ., China; ²Sun Yat-Sen Univ., China. The plasmonic coupling between Gold nanorods can effectively enhance the photo-thermal convention efficiency. A rapid photo-thermal damage of cancer cells cultured with Gold nanorods in low laser power can be achieved by using this coupling.

Su2A.187

Surface plasmon enhanced whispering gallery mode resonance in a hybrid microsphere resonator, Hongdan Wan¹, Han Cao¹, Shengtao Jiang¹, Yu Xiao¹, Ji Xu¹, Jin Wang¹; ¹Nanjing Univ. of Posts and Telecommunications, China. Whispering gallery mode (WGM) resonance in a hybrid microsphere resonator is enhanced with surface plasmon induced by a nanoparticle attached to the coated spherical surface. The strengthened WGM resonance promises high sensitive detection ability.

Su2A.188

The Photoelectric Acquisition and Motion Artifact Elimination of Photoplethysmographic Signals, Xueguang Yuan¹; ¹Beijing Univ Posts & Telecommunications, China. In this paper we proposed a photoelectric acquisition and motion artifact elimination scheme of PPG signals. Two different lights and a simultaneous accelerator are employed in the optical sensors. An efficient algorithm that eliminate the motion artifact is proposed. Its effectiveness is demonstrated with experiments.

Su2A.189

Low-Power Laser Irradiation Promotes Reactive Oxygen Species Production in L6 Myotubes, Gong L. long¹, Lei Liu¹, Da Xing¹; ¹South China Normal Univ., China. The mechanisms of low-power laser therapy remain unknown. Laser scanning microscope assay showed low-level laser irradiation promoted reactive oxygen species (ROS) production in L6 myotubes, which might become a potential approach to regulate muscle-related diseases.

Su2A.190

Employing upconversion luminescent materials for deep-tissue photoacoustic imaging, Wei Wei¹; ¹Chemistry, Inst. for Lasers, Photonics and Biophotonics, USA. We introduce a design of paired contrast agent which employs upconversion luminescent material that can convert near-infrared light into shorter wavelength to excite visible-absorbing photoacoustic probes to realize deep-tissue photoacoustic imaging.

Su2A.191

Fluorescence emission difference microscopy by employing upconversion nanoparticles, Qiusheng Wu^{2,1}, Bingru Huang², Rui Pu², Chao Zhou², Xiuya Su², Qiuqiang Zhan²; ¹South China Normal Univ., China; ²South China Academy of Advanced Optoelectronics, Centre for Optical and Electromagnetic Research (COER), China. We experimentally realized fluorescence emission difference microscopy (FED) using NaYF₄:Nd³⁺/Yb³⁺/Er³⁺@NaYF₄:Nd³⁺ upconversion nanoparticles, which can be efficiently excited by 808 nm CW laser and emit green and red emission. Spatial resolution of $\lambda/6$ is achieved.

Su2A.192

Low-power Laser Irradiation Enhances Macrophage Phagocytic Capacity via Rac1 Activation, Haocai Chang¹, Jie Li¹, Lei Liu¹, Da Xing¹; ¹MOE Key laboratory of Laser Life Science, China. Low-power laser irradiation can enhance the phagocytosis of macrophages, but the underlying mechanisms still remain unknown. Here, we found that the activation of Rac1 is key for upregulation of macrophage phagocytic capacity in LPLI treatment.

Su2A.193

Calcium-Sensing Receptor (CAS) Enhances Salicylic Acid-Induced Plant Resistance, Wenjun Gong¹, Jun Zhou¹, Da Xing¹; ¹South China Normal Univ., China. The mechanism of Calcium-sensing receptor (CAS) in plant resistance remains unclear. Laser scanning microscope assay showed the promoting of Ca²⁺, which might become a potential approach for CAS participates in salicylic acid (SA)-induced plant resistance.

Su2A.194

Cancer Phototherapy-induced Apoptotic Tumor Cells Activate Dendritic Cells, Jie Li¹, Lei Liu¹, Da Xing¹; ¹South China Normal Univ., China. Cancer immunotherapy focus on utilizing the effective immune response to eradicate tumors. High-fluence, low-power laser irradiation (HF-LPLI), as a mitochondria-targeting cancer phototherapy, induced cancer cells apoptosis, which activated dendritic cells (DC).

Su2A.195

Efficient optical depletion of upconverting luminescence for potential multi-photon STED-like microscopy, Qiusheng Wu¹, Ruitao Wu¹, Baoju Wang¹, Bingru Huang¹, Xiuya Su¹, Sailing He¹, Qiuqiang Zhan¹; ¹South China Normal Univ., China. We experimentally demonstrated that 56% of the two-photon green luminescence induced by 795-nm laser in Yb³⁺/Er³⁺ doped upconverting nanoparticles (UCNPs) could be depleted by an 1140-nm laser. This finding has great potential in multi-photon STED-like microscopy.

Su2A.196

Low-level Laser Therapy Attenuates A β -induced Neurotoxicity, Qi Shen¹, Lei Liu¹, Da Xing¹; ¹South China Normal Univ., China. The mechanisms of low-level laser therapy (LLLT) remains unknown. LLLT alleviates beta amyloid induced neuronal cytotoxicity, and dendritic atrophy. This research provides a rational foundation for the application of LLLT in treatment of Alzheimer's disease.

Su2A.197

Study on hydrophilic modification of PDMS, Yanan Zhang¹; ¹Key Laboratory of Optoelectronic Information and Sensing Technologies of Guangdong Higher Education Inst.s, China. We coat gelatin and Fibrinogen on the PDMS surface respectively to increase the PDMS hydrophilic, then test contact angles and cell growth. Results show that PDMS modified by FN has the best hydrophilicity and cellular state.

Magnolia, Track 1

14:00–16:00

Su3A • SDM Fiber and Device Technologies II

President: Yong-min Jung;
Optoelectronics Research Centre (ORC), UK

Hydrangea, Track 2

14:00–16:00

Su3B • Coherent Algorithm

President: Fred Buchali; Nokia Bell Labs, Germany

Hibiscus, Track 2

14:00–16:00

Su3C • Access and SDM Networks

President: Limei Peng; Ajou Univ., Korea

Begonia, Track 3

14:00–16:00

Su3D • Silicon Photonics I

President: Yu Yu; Wuhan National Lab for Optoelectronics, China

Orchid, Track 4

14:00–16:00

Su3E • Integrated Microwave Photonics

President: Nathan Gomes; Univ. of Kent at Canterbury, UK

Su3A.1 • 14:00 **Tutorial**

Few-Mode Multicore Fibers and Fiber Devices, Guifang Li¹; ¹Univ. of Central Florida, USA. This tutorial will cover the design and fabrication of few-mode fibers and few-mode fiber devices for space-division multiplexing for both long-haul and short-reach applications.

Su3B.1 • 14:00 **Invited**

Probabilistic Constellation Shaping and Coding: Essential Elements for Capacity-Approaching Optical Communications, Junho Cho¹, Sethumadhavan Chandrasekhar¹, Xi Chen¹, Greg Raybon¹, Peter J. Winzer¹; ¹Nokia Bell Labs, USA. Coding and modulation are two key elements to approach the Shannon limit. As forward-error correction has become indispensable for optical communications, probabilistic constellation shaping (PCS) is becoming the next essential element. This work discusses the benefits and challenges of PCS.

Su3C.1 • 14:00

Software Defined 5G Converged Mobile Access Networks: Energy Efficiency Considerations, Andrea Marotta¹, Koteswararao Kondepudi², Swapna Doddikrinda¹, Dajana Cassioli¹, Cristian Antonelli¹, Luis M. Correia³, Luca Valcarenghi²; ¹Univ. of L'Aquila, Italy; ²Scuola Superiore Sant'Anna, Italy; ³Instituto Superior Técnico / INOV-INESC, Univ. of Lisbon, Portugal. Software Defined Mobile Networks and Software Defined Access Networks bring programmability principle into mobile and optical domains. In this work we propose an integrated control approach and show the benefit in terms of energy efficiency.

Su3C.2 • 14:15

EDCAR: Enhanced Distributed Coding-Aware Routing for Flying Ad-hoc Networks, Weijing Qi¹, Qingyang Song¹, Lei Guo¹, Jiayu Sun¹; ¹Northeastern Univ., China. An Enhanced Distributed Coding-Aware Routing (EDCAR) algorithm is proposed in Optical Flying Ad Hoc Networks (OFANET). Simulation results show that EDCAR has good performance in terms of network throughput and packet delivery ratio.

Su3D.1 • 14:00

Integrated Polarizer with Tilted Polarization Angle, Wenhao Wu¹, Yu Yu¹, Xinliang Zhang¹; ¹Wuhan National Laboratory for Optoelectronics, China. A polarizer with polarization angle other than 0° or 90° is proposed on silicon-on-insulator platform. The extinction ratio is larger than 20 dB and excess loss is lower than 1 dB in 100 nm wavelength range.

Su3D.2 • 14:15

Contribution of electrostriction and radiation pressure to Kerr-like nonlinearities in silicon pedestal waveguides, Yaojing Zhang¹, Zhenzhou Cheng², Yifei Yao¹, Hon Ki Tsang¹; ¹The Chinese Univ. of Hong Kong, China; ²The Univ. of Tokyo, Japan. We experimentally and theoretically study the Kerr nonlinear-index coefficient of air-cladding silicon pedestal waveguides and find an enhancement due to the light-sound interaction compared to that of conventional silicon-on-insulator waveguides.

Su3E.1 • 14:00 **Invited**

Monolithic Integration of Photonic Microwave Filters, Jose Capmany¹, Daniel Perez¹, Ivana Gasulla¹; ¹Universidad Politecnica de Valencia, Spain. This presentation will discuss monolithic integration of photonic microwave filters.

Dahlia, Track 5

14:00–15:45

Su3F • Metasurface and Metamaterial I

Presider: Cheng-wei Qiu; National Univ. of Singapore, Singapore

Su3F.1 • 14:00 Invited
Nonlinear Dielectric Metasurfaces for Manipulation of Classical and Quantum Light, Dragomir N. Neshev¹; ¹*The Australian National Univ., Australia*. We demonstrate how ultra-small dielectric nanocrystals ordered in a metasurface can enable enhanced light-matter interaction for efficient nonlinear wave-mixing and in particular, to enhance the second harmonic generation and spontaneous parametric down conversion.

Napoleon, Track 6

14:00–16:00

Su3G • OLED & Optical Communication

Presider: Chuluo Yang; Wuhan Univ., China

Su3G.1 • 14:00 Invited
Next-generation High-performance OLEDs: From Triplet Exciton Fusion to Spin-state Inversion, Dawei Di¹; ¹*Cavendish Laboratory, Univ. of Cambridge, UK*. The spin of excitons plays a key role in OLED operation. We explore two important avenues for high-efficiency OLEDs, including triplet exciton fusion and the recently discovered rotationally accessed spin-state inversion (RASI) mechanism in carbene-metal-amide materials.

Louis XIII, Track 7

14:00–16:00

Su3H • Novel PV

Presider: Paul Mulvaney; Univ. of Melbourne, Australia

Su3H.1 • 14:00 Tutorial
Simultaneous Plasmon –Optical and –Electrical Effects for a New Class of Plasmonic Solar Cells, Wallace C. Choy¹; ¹*Electrical and Electronic Engineering, Univ. of Hong Kong, China*. The remarkable enhancement of plasmon -optical and -electrical effects by metal nanostructures will be described in detail for high performance solar cells. For plasmonic organic solar cells, the power conversion efficiency can reach over 10.5%.

Marigold, Track 8

14:00–16:00

Su3I • Super-resolution Optical Imaging Technologies

Presider: Ruikang Wang; Univ. of Washington, USA

Su3I.1 • 14:00 Invited
Super-resolution: 3-D Imaging, Multiparticle Parallel Tracking, and Time-resolved Imaging, Junle Qu¹; ¹*Shenzhen Univ., China*. This talk will present our recent work in super-resolution optical microscopy, including techniques for 3-D super-resolution optical imaging, multiparticle parallel localization and tracking in transparent sample, as well as super-resolution time-resolved imaging.

Bauhinia, Track 3

14:00–16:00

Su3K • Mode Division Multiplexing and Orbital Angular Momentum Devices

Presider: Xinlun Cai; Sun Yat-Sen Univ., China

Su3K.1 • 14:00 Invited
Title to be Announced, Marc Sorel¹; ¹*Univ. of Glasgow, UK*. Abstract not available.

Kapok, Joint

14:00–16:00

Su3L • Best Student Paper Competition II

Su3L.1 • 14:00
Solution-processing metallic networks with the ultra-low sheet resistance, Songru Li¹; ¹*South China Normal Univ., China*. Transparent conducting electrodes (TCEs) are essential components of many applications. We developed an inexpensive metallic ribbon networks (MRNs) by employing the self-cracking technique. The resulting network achieves a high figure of merit of over 30000.

Su3L.2 • 14:15
Fully suspended nanophotonic waveguide resonators with high quality factor and tailorable operational bandwidth, Wen Zhou¹, Zhenzhou Cheng², Xinru Wu¹, Ming Feng^{1,3}, Xiankai Sun¹, Hon Ki Tsang¹; ¹*The Chinese Univ. of Hong Kong, China*; ²*The Univ. of Tokyo, Japan*; ³*Nankai Univ., China*. We demonstrate fully suspended nanophotonic waveguide ring and racetrack resonators with high loaded quality factors of 39,900 and 40,600 respectively in the mid-infrared regime. A two-fold enhancement in the operational bandwidth is achieved.

Magnolia, Track 1

Su3A.2 • 14:45

Partially Degenerate Inter-Modal Four Wave Mixing Studies in Few-Mode Fiber in an All-Fiber Configuration, Smaranika Swain¹, Varun A. Kelkar¹, Deepa Venkitesh¹; ¹IIT Madras, India. Partially degenerate inter-modal four wave mixing in a two-mode graded index fiber is demonstrated in an all-fiber configuration with non-mode selective coupling. Experimentally observed phase matching conditions are found to agree with analytical results.

Su3A.3 • 15:00

Proposal of a PLC-based 4-mode demultiplexer, Tomoya Ano¹, Hirokazu Kubota¹, Yuji Miyoshi¹, Masaharu Ohashi¹; ¹Osaka Prefecture Univ., Japan. We propose a PLC-based 4-mode demultiplexer and numerically investigate four mode separation of the demultiplexer. Insertion loss of each mode is calculated by scattering parameter of the device.

Hydrangea, Track 2

Su3B.2 • 14:30

Kalman Filter for Carrier Phase Recovery in Coherent Transmission Systems Employing Fast Tunable Lasers, Fan Liu¹, Yi Lin², Liam P. Barry², Yonglin Yu¹; ¹Wuhan National Laboratory for Optoelectronics, China; ²Dublin City Univ., Ireland. We experimentally demonstrate that Kalman filter based carrier phase recovery can be used to overcome the excess phase noise of fast tunable lasers. The proposed method also shows good performance in parallelized systems.

Su3B.3 • 14:45

Joint Equalization Scheme of Polarization-state and Polarization Mode Dispersion Based on Extended Kalman Filter, Hengying Xu^{1,2}, Xianfeng Tang¹, Liangze Cui¹, Qisong Shang¹, Nannan Zhang¹, Lixia Xi¹, Wenbo Zhang¹, Xiaoguang Zhang¹, Chenglin Bai²; ¹Beijing Univ. of Posts & Telecom, China; ²Liaocheng Univ., Shandong Provincial Key Laboratory of Optical Communication Science and Technology, China. We propose and demonstrate experimentally an equalization scheme based on Extended Kalman filter to cope with joint polarization impairments. Under fast SOP rotation we can achieve high tolerances of DGD and SOPMD with 50ps and 3486 ps², respectively.

Su3B.4 • 15:00

Linewidth-Tolerant Carrier Phase Estimation Scheme using Quasi-QPSK-Partitioning for 64-QAM Coherent Systems, Tao Yang¹, Huan Chen¹, Xue Chen¹, Xiao Luo²; ¹Beijing Univ. of Posts and Telecommunications, China. We propose a linewidth-tolerant carrier phase estimation scheme using Quasi-QPSK-Partitioning for 64-QAM signals. Comprehensive numerical simulation results demonstrate its effectiveness and greatly enhanced linewidth tolerance to the conventional method.

Hibiscus, Track 2

Su3C.3 • 14:30

A New Architecture for Space Information Networks Based on an MEO Constellation Optical Backbone Network, Jiayu Sun¹, Weijing Qi¹, Qingyang Song¹, Lei Guo¹; ¹Northeastern Univ., China. A new space information network architecture based on MEO constellation optical backbone network is proposed and a mesh-based MEO constellation is designed. Simulation results verify the good coverage, connection and access performance of MEO constellation.

Su3C.4 • 14:45

United Resource Optimization in Time and Frequency for Virtualized Heterogeneous Network Cloud Based Radio over Fiber Network with CoMP, Jinyu Guo¹, Hui Yang¹, Ao Yu¹, Wei Bai¹, Hongyun Xiao², Jie Zhang¹; ¹Beijing Univ. of Post and Telecommu, China; ²ZTE Corporation, China. We proposed a virtualized heterogeneous network cloud based radio over fiber (V-HCROFN) architecture with CoMP to optimize resource for heterogeneous network. Simulation results show that the V-HCROFN can enhance the end-to-end quality of service.

Su3C.5 • 15:00

Experimental Demonstration of Bandwidth Customization for Software Defined Optical Access Network, Xin Tang¹, Lei Wang¹, Liqian Wang¹, Xue Chen¹; ¹Beijing Univ. of Posts and Telecomm., China. We develop a platform which supports access bandwidth customization and bandwidth calendaring (BWC) to enable user-oriented network control based on software defined optical access networks (SDOAN). In this platform, customers could use network resources on demand that demonstrates the flexibility of network and improvement of users' experience.

Begonia, Track 3

Su3D.3 • 14:30 **Invited**

Silicon Photonic Waveguides and Devices with Structural Asymmetry, Daoxin Dai¹; ¹Zhejiang Univ., China. This paper gives a review for recent progresses on silicon photonic waveguides and devices with structural asymmetry, including special power splitters/couplers, high-performance polarization-handling devices, and efficient mode converters/(de)multiplexers.

Su3D.4 • 15:00 **Invited**

Co-Design and Co-Integration of Photonic and Electronic Circuitry: the H2020 WIPE approach, Xin Yin¹; ¹IDLab, imec - Ghent Univ., Belgium. Effective co-design and co-integration of photonics and electronics allows for miniaturization and subsequently energy and cost savings. We describe the EU H2020 WIPE approach towards photonic/electronic integrated circuitry co-optimization and wafer-scale integration.

Orchid, Track 4

Su3E.2 • 14:30 **Invited**

Microcomb-based Microwave Photonics, Xiaoxiao Xue¹, Yi Xuan², Shangyuan Li¹, Xiaoping Zheng¹, Minghao Qi², Andrew M Weiner²; ¹Tsinghua Univ., China; ²Purdue Univ., USA. Miniature comb sources based on optical microresonators can benefit a wide range of microwave photonic applications. This talk introduces on-chip high-efficiency comb generation and its application in microwave photonic signal processing and true-time-delay beamforming.

Su3E.3 • 15:00

Investigation of using SOA for Arbitrary Signal Processing based on Cascaded Microwave Photonic Subsystems, Suen Xin Chew¹, Xiaoke Yi¹, Jianfu Wang¹, Keith Powell¹, Linh Nguyen¹; ¹School of EIE, Australia. We investigate the impacts of using SOA for cascaded microwave photonic subsystems on the RF performance metrics by using different modulation conditions to emulate the signal variations in a link with distributed signal processing functionalities.

Dahlia, Track 5

Su3F.2 • 14:30 **Invited**
Metasurface-Based Photonic Devices, Nanfang Yu¹; ¹*Columbia Univ., USA*. I will describe the effort of my research lab in creating flat optical devices that show record-breaking performance and new functionalities. These include small footprint integrated photonic devices, broadband achromatic flat lenses, flat optical modulators, and biomimetic radiative cooling coatings.

Su3F.3 • 15:00
Monolithic integrated optical vortex sorter based on cascaded metasurface structures, Yuanhui Wen¹, Jiangbo Zhu², Yujie Chen¹, Lidan Zhou¹, Lin Liu¹, Chun-chuan Yang¹, Yanfeng Zhang¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. We propose an experimental scheme for the fabrication of two-layer metasurface structures on both sides of a plate by optical alignment, which has relatively high alignment accuracy around 1 μm . A monolithic optical vortex sorter composed of two-layer metasurface structures is thus demonstrated.

Napoleon, Track 6

Su3G.2 • 14:30 **Invited**
Intramolecular or Intermolecular Charge Transfer Approaches for Highly Efficient TADF Materials and OLEDs, Ken-Tsung Wong^{1,2}; ¹*National Taiwan Univ., China*; ²*Inst. of Atomic and Molecular Science, Academia Sinica, China*. Thermally activated delayed fluorescence (TADF) organic materials achieved either by subtle manipulations of intramolecular or intermolecular charge transfer and their applications for giving OLEDs with high external quantum efficiency (EQE) will be presented.

Su3G.3 • 15:00
Radiation Pattern Modeling of a Bent OLED Panel for Visible Light Communication, Hanjie Chen¹, Zhengyuan Xu¹; ¹*USTC, China*. The radiation pattern of a bent organic light-emitting diode (OLED) panel is tested and modeled for the first time, which is more suitable for visible light communication than the generalized Lambertian pattern.

Louis XIII, Track 7

Su3H.2 • 14:45 **Invited**
Plasmonic Nanostructure Fabrication and Near-field Optical Characterization, Zheyu Fang¹; ¹*Peking Univ., China*. In this presentation, we will demonstrate our latest results of the design of new plasmonic nanostructures and the characterization of surface plasmon nanostructures with 2D materials by using Near-field Optical Microscopy.

Marigold, Track 8

Su3I.2 • 14:30 **Invited**
Super-resolution: better, deeper, and richer information, Peng Xi¹, Xusan Yang¹, Karl Zhanghao¹, Miaoyan Wang¹; ¹*Peking Univ., China*. Super-resolution microscopy has enabled us to visualize biological subcellular world in a greater depth. Several key developments are presented: interference standing-wave enabled MEANS-STED, upconversion enabled ultralow power STED, and super-resolution dipole orientation microscopy (SDOM).

Su3I.3 • 15:00 **Invited**
Achieving High-efficiency Emission Depletion Nanoscopy by Employing Cross Relaxation in Upconversion Nanoparticles, Qiuqiang Zhan¹; ¹*South China Normal Univ., China*. Upconversion nanoparticles, which do not suffer from the photophysical artifacts limiting fluorescent molecules, offer an exciting opportunity for biological super-resolution imaging. We develop an efficient STED mechanism using lanthanide upconversion nanoparticles, enabling cytoskeleton nanoscopic imaging.

Bauhinia, Track 3

Su3K.2 • 14:30
Orbital Angular Momentum Mode Multiplexer Based on Bilayer Concentric Micro-Ring Resonator, Shimao Li¹, Zhichao Nong¹, Shengqian Gao¹, Mingbo He¹, Liu Liu², Si-Yuan Yu¹, Xinlun Cai¹; ¹*Sun Yat-sen Univ., China*; ²*South China Normal Univ., China*. We demonstrate silicon photonic orbital angular momentum multiplexing devices based on concentric micro-ring resonator. Up to four optical beams carrying different orbital angular momentum states can be selectively excited from different input ports.

Su3K.3 • 14:45
An integrated orbital angular momentum quantum dot single photon emitter, Shunfa Liu¹, Ying Yu¹, Lin Liu¹, Lidan Zhou¹, Siyuan Yu^{1,2}; ¹*School of Electronics and Information Technology, Sun Yat-sen Univ., China*; ²*Photonics Group, Merchant Venturers School of Engineering, Univ. of Bristol, UK*. We demonstrate an integrated orbital angular momentum (OAM) single photon emitter based on InAs quantum dots (QDs) embedded in micropillar cavity. The micropillar is fabricated around a single QD with high accuracy using an optical positioning method, and integrated with the spiral phase plates to generate deterministic OAM-carrying single photons.

Su3K.4 • 15:00
Direct generation of orbital angular momentum beams by integrating all-dielectric metasurface to vertical-cavity surface-emitting laser, Yaqi Sun¹, Jiangbo Zhu², Shunfa Liu¹, Ying Yu¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. We demonstrate a vertical-cavity surface-emitting laser, with an integrated all-dielectric metasurface, generating vortex-like coherent state in the Laguerre-Gauss basis. This coherent photonic device was theoretically calculated and experimentally characterized to achieve both high transmission efficiency and high OAM purity.

Kapok, Joint

Su3L.3 • 14:30
Tunable 3D Integrated Hybrid Silicon Laser, Bowen Song¹, Sergio Pinna², Sasa Ristic², Jonathan Klamkin¹; ¹*Univ. of California Santa Barbara, USA*; ²*McGill Univ., Canada*. Tunable 3D integrated hybrid silicon lasers were demonstrated with side-mode suppression ratio of 43 dB, output power of 2 mW, laser linewidth of 1.5 MHz, and relative intensity noise of -132 dB/Hz.

Su3L.4 • 14:45
Microring-based 32-channel hybrid multiplexer for mode/wavelength-division-multiplexing, Ying Tan¹, Daoxin Dai¹, Chenlei Li¹; ¹*Zhejiang Univ., China*. A novel silicon-based hybrid multiplexer consisting of a mode (de)multiplexer and a microring-resonator (MRR) array is proposed and demonstrated for mode-division-multiplexing and wavelength-division-multiplexing system.

Su3L.5 • 15:00
Generation of vectorial vortex beams with switchable radial and azimuthal polarizations, Zengkai Shao¹, Yanfeng Zhang¹, Jiangbo Zhu², Yujie Chen¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. We designed and experimentally demonstrated a silicon nitride microring resonator-based vectorial vortex beams. The device is capable of generating broad-band radially and azimuthally polarized vortex beams by switching the polarization and wavelength of the excited WGMs.

Magnolia, Track 1**Su3A.4 • 15:15**

A fiber laser capable of simultaneously exciting multiple higher-order modes in 1550 nm band, Yang Mi¹, Li Gao¹, Mingying Lan¹, Shanyong Cai¹, Song Yu¹; ¹*Beijing Univ. of Posts and Telecom., China*. In this paper, a fiber laser scheme for exciting multiple higher-order modes simultaneously is proposed based on ring cavity in 1550 nm band. The feasibility and the performance of the scheme is also demonstrated.

Su3A.5 • 15:30 **Invited**

Photonic Lantern: harnessing multimode photonics for optical communications, Sergio G. Leon-Saval¹; ¹*Univ. of Sydney, Australia*. Advances in space-division multiplexing systems urges research towards more mode-data-channels. Photonic lantern is an all-optical multimode photonic device that allows for broadband low-loss mode multiplexing in optical communications.

Hydrangea, Track 2**Su3B.5 • 15:15**

Real-Time Real-valued Adaptive Channel Equalizer in 10-Gb/s PDM-QPSK Coherent Receiver, Jie Li^{1,2}, Tao Zeng², Xiang Li², Ming Luo¹, Liheng Meng²; ¹*Wuhan National Laboratory for Optoelectronics & School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China*; ²*WRI, China*. To compensate the delay skew and imbalance for received signals, we realize a real-valued equalizer in 10-Gb/s real-time PDM-QPSK coherent systems. It shows better performance than conventional complex-valued equalizer with only small resources consumptions increase.

Su3B.6 • 15:30

Simplified Blind Phase Search for Low-complexity Carrier Phase Estimation of M-ary QAM Format, Xie Chenhui¹, Songnian Fu¹, Jianing Lu¹, Lei Deng¹, Ming Tang¹, Deming Liu¹; ¹*School of Optics and Electronic Information, HUST, China*. We experimentally demonstrate a novel carrier phase estimation (CPE) scheme based on real distance-blind phase search (RD-BPS) for M-QAM. Compared with traditional BPS, the RD-BPS is verified to reduce the complexity without performance degradation.

Hibiscus, Track 2**Su3C.6 • 15:15**

Crosstalk-aware Spectrum Defragmentation in Space Division Multiplexing Elastic Optical Networks, Liyazhou Hu¹, Yongli Zhao¹, Ruijie Zhu¹, Xiaosong Yu¹, Jie Zhang¹, Zhu Liu²; ¹*Beijing Univ of Posts & Telecom, China*; ²*State Grid Information & Telecommunication Group Co, China*. We propose two spectrum defragmentation strategies for space division multiplexing elastic optical networks. Simulation shows defragmentation triggered by spectrum-compactness is better at optimizing spectrum utilization than that by blocking, but it adjusts spectrum more frequently.

Su3C.7 • 15:30

Routing, Spectrum, and Core Allocation with Super-Channels in SDM-WDM Optical Network, Shan Yin¹, Yu Shang¹, Tao Gao¹, Xin Li¹, Bingli Guo¹, Shanguo Huang¹; ¹*Beijing Univ of Posts & Telecom, China*. We propose a routing, spectrum and core allocation scheme with super-channels considering XT, fragmentation and switching cost. Choosing granularity of super-channels is part of the scheme. 15% improvement in spectrum efficiency can be achieved.

Begonia, Track 3**Su3D.5 • 15:30** **Invited**

Recent Advances in All-Optical Signal Processing in Silicon Photonics, Lawrence R. Chen¹, Zifei Wang¹, Junjia Wang¹, Ivan Glesk³, Rhys Adams²; ¹*McGill Univ., Canada*; ²*Dept. of Physics, CEGEP Vanier College, Canada*; ³*Dept. of Electronic and Electrical Engineering, Univ. of Strathclyde, UK*. We review recent work on all-optical signal processing in silicon photonics. In particular, we describe the integration of a nonlinear optical loop mirror in silicon-on-insulator for applications including wavelength conversion, NRZ-to-RZ modulation format conversion, and optical time-division de-multiplexing.

Orchid, Track 4**Su3E.4 • 15:15**

Tunable optical true time delay lines based on SiN_x arrayed waveguide grating and spirals, Jiejun Lu¹, Zengkai Shao¹, Yi Wang¹, Yanfeng Zhang¹, Lin Liu¹, Chunchuan Yang¹, Yujie Chen¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. We fabricate a tunable OTTD lines based on AWG and spirals in the SiN_x platform. The AWG measurements show an insertion loss of about 6.5 dB of TE mode and a crosstalk of <-10 dB, and loss of the spirals is about 2.6 dB/cm.

Su3E.5 • 15:30

Graphene/MoS₂ heterostructure photodetector integrated with silicon nitride micro-ring resonators at visible wavelengths, Tianyou Zhang¹, Zeru Wu¹, Yujie Chen¹, Yanfeng Zhang¹, Zengkai Shao¹, Lin Liu¹, Lidan Zhou¹, Chunchuan Yang¹, Hui Chen¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. In this work, we fabricate a graphene/MoS₂ heterostructure photodetector integrated on silicon nitride micro-ring waveguide resonators. Taking advantage of resonant mode coupling with two-dimensional materials, our device obtains a photoresponsivity of 0.58 A/W.

Dahlia, Track 5**Su3F.4 • 15:15**

An ultra-broadband tunable graphene-based metamaterial absorber in terahertz range, Zenghui Xu¹, Yumin Liu¹; ¹Beijing Univ of Posts & Telecom, China. We propose and numerically demonstrate an ultra-broadband graphene-based metamaterial absorber with 4.8 THz bandwidth of over 90% absorption and it can be switched from absorption (>90%) to reflection (>90%) within the whole operation bandwidth.

Su3F.5 • 15:30

Meta-gratings with near-unitary transmission or diffraction, Zi-Lan Deng¹, Yaoyu Cao¹, Xiangping Li¹, Guo Ping Wang²; ¹Jinan Univ., China; ²Shenzhen Univ., China. We show that, a meta-grating composed of subwavelength metallic slit array embedded in an asymmetric dielectric environment can exhibit either near-unitary resonant transmission or diffraction, depending on the incident angle.

Napoleon, Track 6**Su3G.4 • 15:15**

Key Parameter Accuracy Analysis Method for the Spatial viewing zones Model of Grating Free Stereo Display, Jing J. Li¹; ¹Qualper (shanghai) Photoelectric Co.,Ltd, China. Spatial viewing zones; Space model; key parameter; Peak position; width of the Spatial viewing zones; height of the Spatial viewing zones; Vertical angle; Horizontal angle; Accuracy; analysis

Su3G.5 • 15:30

An Indoor Visible Light Positioning Based on Image processing, Kai He¹, Shilin Gui¹, Zhong Zheng¹; ¹State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking Univ., Beijing 100871, China. An effective indoor positioning system based on visible light communication (VLC), focusing on the image processing. Accurate edge and identity detection algorithm is exploited for image processing to decline positioning error.

Louis XIII, Track 7**Su3H.3 • 15:15** **Invited**

Interface and Tandem Design for High Performance Polymer Solar Cells, Hin-Lap Yip¹; ¹South China Univ. of Technology, China. New conjugated polymer-based interfacial materials with desired electrical conductivity, energy levels, optical property and processibility to improve the charge collection efficiency for high performance semitransparent and tandem polymer solar cells will be discussed.

Marigold, Track 8**Su3I.4 • 15:30**

Generation of constructed beams via spiral pinholes screen, Yongqun Zhu², Longjie Zhou¹, Linli Liu²; ¹Research Inst. Electronic Science and Technology, Univ. of Electronic Science and Technology of China, China; ²School of Aeronautics and Astronautics, Univ. of Electronic Science and Technology of China, China. Structured beams such as vortex beams have been widely studied as promising resources due to the unique properties and it's significant potential for modern optical technologies ranging from quantum communication to optical manipulation. This paper introduces a new method to construct vortex beams with different shape via spiral pinholes screen.

Bauhinia, Track 3**Su3K.5 • 15:15**

Six-Mode Multiplexer with Cascaded Vertical Asymmetric Waveguide Directional Couplers, Quandong Huang¹, Yunfei Wu¹, Wei Jin¹, Kin S. Chiang¹; ¹Dept. of Electronic Engineering, City Univ. of Hong Kong, China. We design a six-mode (de)multiplexer with five cascaded vertical asymmetric waveguide directional couplers. Our device fabricated with polymer material achieves coupling ratios higher than 67% and modal crosstalks lower than -11.6 dB at 1550 nm.

Su3K.6 • 15:30

Linear optical transformation with quasi-angle states and quasi-orbital angular momentum states, Peng Zhao¹, Xuesi Zhao¹, Xue Feng¹, Yidong Huang¹; ¹Tsinghua Univ., China. A scheme of linear optical transformation based on quasi-angle states and quasi-orbital angular momentum states has been demonstrated with two spacial light modulators, a pinhole and a lens. In experiments, the generalized Pauli clock and shift matrix as well as the discrete Fourier transform matrix have been achieved with dimensionality of 7.

Kapok, Joint**Su3L.6 • 15:15**

Femtosecond pulsed beam induced shape transition of aluminum nanodisks, Yudong Lu¹, Dejjiao Hu¹, Xiangping Li¹, yaoyu cao¹, Lechen Yang²; ¹Jinan Univ., China; ²Inst. of Physics, Chinese Academy of Sciences, China. We present using tightly focused femtosecond laser beam to precisely control the shape transition of Al nanodisks. It provides a method to print high density color information that can be used in information security fields.

Magnolia, Track 1

Hydrangea, Track 2

Hibiscus, Track 2

Begonia, Track 3

Orchid, Track 4

Su3B.7 • 15:45

High Phase Noise Tolerant Circular-64QAM with Efficient Phase Recovery for Coherent Optical Systems, Jaime Rodrigo Navarro^{1,3}, Aleksejs Udalcovs¹, Xiaodan Pang^{2,1}, Oskars Ozolins¹, Aditya Kakkar^{3,1}, Richard Schatz³, Fredrik Nordwall⁴, Sergei Popov³, Gunnar Jacobsen¹; ¹Networking and Transmission Laboratory, RISE Acreo AB, Sweden; ²School of Information and Communication Technology, KTH Royal Inst. of Technology, Sweden; ³School of Engineering Sciences, KTH Royal Inst. of Technology, Sweden; ⁴Tektronix AB, Sweden. We experimentally demonstrate the significant phase noise tolerance increase of 28Gbaud circular-64QAM constellations against its square-64QAM counterpart with a novel, low complexity and high-performance phase recovery scheme employing only 8 test phases.

Su3C.8 • 15:45

Physical Layer Energy-efficient Scheme Exploiting Clock-gating off Mode in ONUs for OFDM-PON, Youxiang Qin¹, Junjie Zhang¹; ¹Shanghai Univ., China. A novel physical layer energy-efficient scheme exploiting clock-gating off mode in ONUs is proposed. Experimental results show that 54.6% energy consumption in ONU can be saved than conventional scheme without clock-gating off mode.

Su3E.6 • 15:45

Tunable Flat-top Microwave Photonic Filter Based on a Single Microring Resonator, Lei Zhao¹, Simin Li¹, De Ben¹, Shilong Pan¹; ¹Nanjing Univ. of Aeronautics and Astronautics, China. Based on the combined effect of mapping more than one resonant wavelength response to microwave frequency, a tunable flat-top bandpass microwave photonic filter is implemented by a single microring resonator and single sideband modulation.

16:00–16:30 Coffee Break & Exhibition, Corridor 3F and Exhibition Area

Dahlia, Track 5**Napoleon, Track 6****Louis XIII, Track 7****Marigold, Track 8****Bauhinia, Track 3****Kapok, Joint**

Su3G.6 • 15:45
Blue LD-based White Light Source for Joint Lighting and Visible Light Communication, Qiqi Pan¹, Shang-Bin Li¹, Shuang Liang¹, Zhengyuan Xu¹; ¹USTC, China. A blue-LD based white light source with 3dB bandwidth of 650MHz is designed for joint lighting and visible light communication. The design rules and key optoelectronic characteristics of the white light source are presented.

Su3H.4 • 15:45
Applications of Atomic Layer Deposition in Energy Devices, Liang Li¹; ¹Soochow Univ., China. We will present the recent research results about applications of atomic layer deposition in energy devices, including solar cells, photoelectrochemical cells, and electrochemical batteries.

Su3I.5 • 15:45
A Microfluidic Fluorescence Biosensor Based on Three-Dimensional Dual-Gate Photosensitive Thin-Film Transistor, Qi Zhou^{1,2}, Hantao He³, Hai Ou², Jun Chen², Jianhua Zhou⁴, Kai Wang^{1,2}; ¹Sun Yat-sen Univ.-Carnegie Mellon Univ. Shunde International Joint Research Inst., China; ²School of Electronic and Information Technology, Sun Yat-sen Univ., China; ³Dept. of Electrical and Computer Engineering, Iowa State Univ., USA; ⁴School of Engineering, Sun Yat-sen Univ., China. We propose a microfluidic fluorescence biosensor based on a DGPTFT. The compact system including high-brightness laser or LED, filters, microfluidic channel-integrated DGPTFT, and readout circuit. Our proof-of-concept system can detect fluorescent concentration in nMol range.

Su3K.7 • 15:45
Broadband five-mode (de)multiplexer with horizontal tapered directional couplers, Weike Zhao¹, Kaixin Chen¹, JieYun Wu¹, Xuepeng Li¹, KinSeng Chiang²; ¹Key Laboratory of Optical Fiber Sensing and Communications, Univ. of Electronic Science and Technology of China, China; ²Dept. of Electronic Engineering, City Univ. of Hong Kong, China. We design and fabricate a five-mode (de) multiplexer consisted of four cascaded horizontal tapered uneven directional couplers. Our typical fabricated device shows an average mode selectivity of > 15.9 dB for all five modes over the C+L band.

16:00–16:30 **Coffee Break & Exhibition, Corridor 3F and Exhibition Area**

Magnolia, Track 1

16:30–18:15

Su4A • Transmission Fiber Systems and Nonlinearity Mitigation

President: To be Announced

Su4A.1 • 16:30 **Invited**

Fiber Nonlinearity Mitigation Using Multiple Optical Phase Conjugations, Hao Hu¹, Robert Jopson²; ¹DTU Fotonik, Denmark; ²Nokia Bell Labs, USA. We experimentally demonstrate fiber nonlinearity mitigation using multiple optical phase conjugations (OPCs) in WDM transmission systems with 8 × 32-Gbaud PDM-QPSK channels and with 8 × 32-Gbaud PDM-16-QAM channels.

Su4A.2 • 17:00

Performance and Reach Comparison of Large-Effective-Area Low-Loss Fiber Links via 256-Gb/s PDM-16QAM WDM Transmissions, Lufeng Leng¹; ¹New York City College of Technology, CUNY, USA. Impact of fiber parameters on the performance and reach of 256-Gb/s PDM-16QAM WDM transmissions has been investigated using experimentally validated EGN model. OSNR improvement and reach extension are assessed for systems employing large-effective-area low-loss fibers.

Hydrangea, Track 2

16:30–18:00

Su4B • High Capacity Systems II

President: Henning Buelow; Nokia Bell Labs, Germany

Su4B.1 • 16:30 **Invited**

Opportunities for Machine Learning in Optical Communication Systems and Networks, Tao Gui¹, Chao Lu¹, Alan Pak Tao Lau¹, P. K. A. Wai¹; ¹Hong Kong Polytechnic Univ., China. Communications for nonlinear optical fiber channels based on Nonlinear Fourier Transform (NFT) has gained attraction as a new communication strategy for nonlinear optical communications. We review recent developments and discuss key challenges in this area

Su4B.2 • 17:00

Low Complexity Single-Step Digital Backpropagation for High-order QAM Subcarrier-Multiplexing Transmission, Xiao Zhuopeng^{2,1}, Qunbi Zhuge^{1,3}, Songnian Fu², Fangyuan Zhang¹, Meng Qiu¹, Ming Tang², Deming Liu², David V. Plant¹; ¹ECE, McGill Univ., Canada; ²School of optical and electronic information, Huazhong Univ. of Science and Technology, China; ³Ciena Corporation, Canada. We demonstrate single-step digital backpropagation (DBP) scheme for subcarrier-multiplexing transmission. With 6.1% complexity of low pass filter aided DBP, our scheme achieves 0.7-dB and 0.6-dB Q² improvement for 1200-km PDM-32QAM and 800-km PDM-64QAM transmission, respectively.

Hibiscus, Track 2

16:30–18:00

Su4C • OFDM

President: Changjian Guo; South China Normal Univ., China

Su4C.1 • 16:30 **Invited**

Adaptively Loaded IM/DD Offset-QAM OFDM Based on Set-Partitioned QAM Formats, Jian Zhao², Calvin C. K. Chan¹; ¹The Chinese Univ. of Hong Kong, China; ²Tyndall National Inst. and Univ. College Cork, Ireland. We propose an adaptive-loading algorithm for SP-QAM formats, and experimentally show that SP-offset-QAM OFDM outperforms conventional offset-QAM OFDM and SP-QAM OFDM in adaptively-loaded IM/DD systems, and achieves >40 Gbit/s at 50 km without any guard interval.

Su4C.2 • 17:00

Joint Mitigation of Residual Carrier Frequency Offset and Phase Noise with Orthogonal Basis Expansion in CO-OFDM, Qifeng Yan¹, Xiaojian Hong², Sailing He^{1,2}, Xuezhi Hong¹; ¹South China Academy of Advanced Optoelectronics, South China Normal Univ., China; ²State Key Laboratory of Modern Optical Instrumentation, Zhejiang Univ., China. A novel carrier recovery method is proposed to jointly mitigate residual carrier frequency offset (RCFO) and phase noise based on orthogonal basis expansion. Numerical results verify RCFO is well compensated under a large laser linewidth.

Begonia, Track 3

16:30–18:00

Su4D • Photonic Integration and Optical Interconnects

President: Jian Wang; Huazhong Univ. of Science and Technology, China

Su4D.1 • 16:30

Compact Resonant Vertical Coupler with Large Fabrication Tolerances for Active-Passive Integration, Can Liu¹, Gongyuan Zhao¹, Qiaoyin Lu¹, Weihua Guo¹; ¹Wuhan National Lab for Optoelectronics, China. We propose a fabrication-tolerant and compact resonant vertical coupler for active-passive integration. The proposed coupler exhibits a width tolerance of ±190nm which is 4 times of the conventional resonant-coupler. The coupler length is 55µm just half of the adiabatic design.

Su4D.2 • 16:45

Polymer waveguide jumper with 3D over-crossing structure for high-density on-board optical interconnects application, Huanhuan Zhang¹, Xiaoyu Yang¹, Lin Ma¹, Zuyuan He¹; ¹Shanghai Jiao Tong Univ., China. We propose and experimentally demonstrate polymer waveguide jumper with 3D over-crossing structure for high-density on-board optical interconnects application. The fabricated device has an insertion loss and inter-channel crosstalk as low as 2.2 and -40 dB.

Su4D.3 • 17:00 **Invited**

2D and 3D Heterogeneously Photonic Integrated Circuits for future Computing and Networking Systems, S. J. Ben Yoo¹; ¹Univ. of California Davis, USA. We discuss 2D and 3D integration of III-V, group-IV, and crystalline/non-crystalline dielectric materials leading to functional circuits for future computing and networking systems. In particular, we will discuss beyond-Moore's computing and temporal/spectral/spatial elastic networking systems.

Orchid, Track 4

16:30–18:00

Su4E • Photonics for 5G II

President: Changzheng Sun; Tsinghua Univ., China

Su4E.1 • 16:30 **Invited**

Support of Multi-antenna and Multi-user Systems Using Radio Over Fiber, Nathan J. Gomes¹, Usman Habib¹, Shabnam Noor¹, Anthony Aighobahi¹, Philippos Assimakopoulos¹; ¹Univ. of Kent at Canterbury, UK. Analog radio-over-fiber can efficiently support multi-antenna and multi-user techniques for future mobile communications. Experimental results demonstrate that the wider antenna separation that can be provided enhances multi-antenna scheme performance.

Su4E.2 • 17:00 **Invited**

RoF-based Mobile Fronthaul Network Implemented by using Directly Modulated Laser, Hoon Kim¹; ¹KAIST, Korea. We explore the feasibility of using directly modulated lasers for the implementation of mobile fronthaul network based on the radio-over-fiber technology. We investigate the effects of multipath interference, dispersion-induced RF power fading, and dispersion-induced nonlinear distortions.

Dahlia, Track 5

16:30–17:45

Su4F • Metasurface and Metamaterial II

President: Min Qiu; Zhejiang Univ., China

Su4F.1 • 16:30 **Invited**

Metasurfaces Based on Dielectric Resonances, Thomas F. Krauss¹, Juntao Li²; ¹Univ. of York, UK; ²School of Physics, Sun Yat-sen Univ., China. A variety of metasurfaces based on different types of photonic resonances is presented, including the demonstration of an active metasurface that generates vortex beams and silicon metasurfaces with competitive efficiency even at visible wavelengths.

Su4F.2 • 17:00 **Invited**

High-Q Nanocavities based on Two-Dimensional Photonic Crystals, Takashi Asano¹, Yasushi Takahashi², Susumu Noda¹; ¹Kyoto Univ., Japan; ²Osaka Pref. Univ., Japan. A heterostructure-type nanocavity based on a two-dimensional photonic crystal slab made from a silicon-on-insulator wafer can realize an experimental Q factor exceeding 11 million. Fundamental properties and applications of such nanocavities are discussed.

Napoleon, Track 6

16:30–17:45

Su4G • Organic Electroluminescent Materials and Devices

President: Ken-Tsung Wong; National Taiwan Univ., China

Su4G.1 • 16:30 **Invited**

Design and Modulation on the Excited State Properties in Organic Electrofluorescence Materials, Shitong Zhang¹, Yu Gao¹, Haichao Liu¹, Bing Yang¹, Yuguang Ma²; ¹Jilin Univ., China; ²South China Univ. of Technology, China. We put forward an excited state modulation method hybrid localized and charge-transfer state (HLCT) for designing low-cost, high-efficiency (photoluminescence and electro-exciton utilization) materials for fluorescent full-color organic light emitting diodes (OLED).

Su4G.2 • 17:00 **Invited**

The Design, Synthesis and Optoelectronic Properties of Side-Chain-Type Thermally Activated Delayed Fluorescent Polymer, Jajia Luo¹, Xun Zeng¹, Guohua Xie¹, Shaolong Gong¹, Chuluo Yang¹; ¹Wuhan Univ., China. Polymeric materials have been proven to be ideal emissive materials for the solution-processed devices. In this presentation, we report some new thermally activated delayed fluorescent polymers with excellent luminescence properties and device performance.

Louis XIII, Track 7

16:30–18:00

Su4H • Water Splitting

President: Xin Wang; South China Normal Univ., China

Su4H.1 • 16:30 **Invited**

How to Build a Solar Water Splitting Photoelectrode, Dunwei Wang¹; ¹Boston College, USA. Solar water splitting promises a practical solution to challenges associated with large scale solar energy harvesting and storage. Due to the stringent requirements for the materials' properties, however, research on solar water splitting has been progressing at a frustratingly slow pace. In this talk, we will examine the detailed considerations on how to best build an efficient photoelectrode of reasonable cost. We will first look at the thermodynamic requirements, and then discuss how these requirements can be met. We will also examine the unique roles played by co-catalysts and how the photoelectrodes may be influenced by the introduction of co-catalyst. At the end, we will provide our perspectives on the future of this important field.

Su4H.2 • 17:00 **Invited**

Optoelectronic Modeling of Heterojunction Photoanode for Water-splitting Application, Li Chen¹, Shaolong Wu¹, Aixue Shang¹, Xiaofeng Li¹; ¹Soochow Univ., China. For dual-absorbable Si/a-Fe₂O₃ heterojunction photoanode, we systematically simulate optical absorption response and the carrier generation, separation, recombination, and collection of the electron-hole pairs so that the complete optoelectronic simulation is realized.

Marigold, Track 8

16:30–18:00

Su4I • Advanced Optical Diagnostic Technologies IV

President: Zhen Yuan; Univ. of Macau, China

Su4I.1 • 16:30 **Invited**

Miniaturization in Optical Resolution Photoacoustic Microscopy, Lei Xi¹; ¹Univ Electronic Science & Technology, China. This talk presents the miniaturization of optical resolution photoacoustic microscopy systems using novel optical and acoustic scanning mechanisms and devices for universal biological and clinical applications.

Su4I.2 • 17:00 **Invited**

New Progresses in Photoacoustic Microscopy and Biomedical Applications, Sihua Yang¹; ¹MOE Key laboratory of Laser Life Science, China. This talk presented the new progress in photoacoustic microscopy, intravascular photoacoustic tomography and all-optically photoacoustic imaging towards pre-clinical and clinical application.

Bauhinia, Track 3

16:30–18:00

Su4K • Photodetectors

President: Ke Xu; Harbin Inst. of Technology, China

Su4K.1 • 16:30

GaAs-Nanowire-Array/Graphene Schottky Diodes for Photodetection, Yao Wu¹, Xin Yan¹, Bang Li¹, Yanbin Luo¹, Qichao Lu¹, Xia Zhang¹, Xiaomin Ren¹; ¹Beijing Univ. of Posts and Telecom, China. A Schottky diode based on GaAs nanowire/graphene heterostructure is fabricated by transferring graphene onto the nanowire array. Under illumination of 532 nm, a responsivity of 1.1 mA/W is achieved at reverse bias of 0.5 V.

Su4K.2 • 16:45

A Novel Hybrid Integrated Uni-Travelling Carrier Photodetector With High Speed and Flat-top Steep-edge Spectral Response, Xinye Fan¹, Ximei Jiang², Wenjing Fang¹, Huijuan Niu¹, Chenglin Bai¹; ¹Liaocheng Univ., China. A novel photodetector, which uses a Si-based multi-cavity filter and an InP-based UTC photodetector, is demonstrated. The device has quantum efficiency of 55%, the excellent spectral response, and 3-dB bandwidth of 24 GHz.

Su4K.3 • 17:00

A High Bandwidth Evanescently Coupled Waveguide InGaAs InP UTC-PD at Zero Bias, Siwei Sun¹, Song Liang¹, Hongliang Zhu¹; ¹Inst. of Semiconductors, Chinese Academy of Sciences, China. We present the fabrication of evanescently coupled InGaAs/InP UTC-PD. The InGaAs absorption layer of the PD is gradedly doped. As a result, a PD having 4 × 15 μm² absorber size has an over 21 GHz bandwidth under zero bias, which is the largest one for evanescently coupled or edge coupled UTC-PD, to the best of our knowledge.

Magnolia, Track 1**Su4A.3 • 17:15**

A Novel In-Service Fiber Link Monitoring Scheme using Bidirectional Infinite Backscatter OTDR, Yan Zhang¹, Liqian Wang¹, Zhiliang Ren², Sheping Shi², Xue Chen¹, JinHao Du¹, Ke Yan¹; ¹Beijing Univ. of Posts and Telecomm, China; ²ZTE corporation, China. This paper proposed a bidirectional IB-OTDR in-service monitoring scheme and a DSP method. The scheme could achieve a dynamic range of 40 dB and a spatial resolution of 20m by simulations.

Su4A.4 • 17:30 **Invited**

Dynamic Phase Matching Control for Enhanced Four-Wave Mixing Processing of Polarization-Division-Multiplexed Coherent Optical Signals, Chester C.T. Shu¹, Chaoran Huang¹; ¹Dept. of Electronic Engineering, the Chinese Univ. of Hong Kong, China. By applying gain-transparent stimulated Brillouin scattering to a dual-orthogonal-pump four-wave mixing scheme, we introduce additional optical phase shift along a nonlinear fiber to improve the efficiency on polarization-insensitive processing of PDM-QPSK communication signals.

Su4A.5 • 18:00

A Study of Nonlinear Coefficient Measurement of Various Types of Single Mode Fibers, Yaping Liu¹, Liyan Zhang¹, Jing Li¹, Hongyan Zhou¹, Xueting Sun¹, Su Chen¹, Zhang Lei¹; ¹yofc, China. We measured the influence of fibre length and wavelength separation on the nonlinear coefficient measurement based on continuous-wave dual-frequency method. Besides, the nonlinear coefficients of various types of single mode fibres are presented.

Hydrangea, Track 2**Su4B.3 • 17:15**

Unrepeated 64QAM over SMF-28 using Raman Amplification and Digital Backpropagation, Pawel Rosa^{2,1}, Giuseppe Rizzelli¹, Xiaodan Pang^{3,4}, Oskars Ozolins⁴, Aleksejs Udalcovs⁵, Mingming Tan⁵, Sergey Sergejev⁵, Richard Schatz³, Gunnar Jacobsen⁴, Sergei Popov³, Juan Diego Castanon¹; ¹Instituto de Óptica, Spain; ²National Inst. of Telecommunication, Poland; ³KTH Royal Inst. of Technology, Sweden; ⁴RISE Acreo AB, Sweden; ⁵Aston Inst. of Photonic Technologies, UK. Unrepeated transmission over SMF-28 fibre is investigated using Raman based amplification. Experiments and simulations demonstrate a transmission up to 200 km (41 dB) span length using 28Gbaud 64 QAM modulation employing digital back propagation in DSP.

Su4B.4 • 17:30

A Joint Technique for Nonlinearity Compensation in CO-OFDM Superchannel Systems, Sunish Kumar O S¹, Abdelkerim Amari¹, Octavia A. Dobre¹, Venkatesan Ramachandran¹, Sarah K. Wilson²; ¹Memorial Univ., Canada; ²Santa Clara Univ., USA. We propose a technique combining single-channel-digital-back-propagation (SC-DBP) with phase-conjugated-twin-wave (PCTW) to compensate nonlinearities in CO-OFDM systems. This exhibits a similar performance as multi-channel-DBP while providing increased transmission-reach compared to SC-DBP, PCTW, and linear dispersion compensation.

Su4B.5 • 17:45

SDN-based In-band Adaptive Synchronization with Self-generated Preamble Detection Scheme, Mingwei Yang¹, Ivan B. Djordjevic¹; ¹Univ. of Arizona, USA. We propose an SDN-based in-band synchronized channel adaptation scheme based on the self-generated preamble detection in the optical networks. The proposed scheme is also implemented and evaluated via a 50 Gbps QPSK optical testbed.

Hibiscus, Track 2**Su4C.3 • 17:15**

Experimental Demonstration of Joint Compensation of Laser Phase Noise and Transmitter IQ Mismatch for Coherent Optical OFDM System, Chao Li¹, Zhengyuan Xu¹, Qi Yang², Shaohua Yu²; ¹USTC, China; ²WRI, China. In this paper, we experimentally demonstrate a novel scheme to jointly compensate laser phase noise and transmitter IQ mismatch for CO-OFDM system. The results show 2/4.8 dB receiver sensitivity gains are successfully achieved for 4-/16-QAM.

Su4C.4 • 17:30

Unsupervised Hierarchical Clustering for Blind Nonlinear Equalization in WDM Coherent Optical OFDM, Elias Giacomidis¹, Amir Matin¹, Jintong Wei², Nick Doran³, Xu Wang¹; ¹Heriot-Watt Univ., UK; ²Huawei Duesseldorf GmbH, Germany; ³Aston Univ., UK. We experimentally demonstrate the first Hierarchical clustering-based blind nonlinear equalizer for QPSK WDM-CO-OFDM. Hierarchical clustering outperforms to full-step digital-back propagation and artificial neural networks at 3200 km by up to 1.5 and 1.1 dB, respectively.

Su4C.5 • 17:45

Linear Interpolation and Eigenvector Basis Expansion Based Almost Blind Phase Noise Suppression Method for CO-OFDM Systems, Zhaopeng Xu¹, Zhongwei Tan¹, Chuanchuan Yang¹; ¹Peking Univ., China. In this paper, we propose an almost blind phase noise suppression method for CO-OFDM systems based on linear interpolation and eigenvector basis expansion. The method shows great system performance without sacrificing spectrum efficiency.

Begonia, Track 3**Su4D.4 • 17:30** **Invited**

System, Board and Chip Level Migration of Photonic Interconnect in the hyperscale Age, Richard Pitwon¹; ¹Seagate Technology, UK. We introduce collaborative research and development activities to drive deployment of photonic interconnect in large scale data centre environments at the system, board and ultimately chip level as a key enabler of future IoT infrastructures.

Orchid, Track 4**Su4E.3 • 17:30**

A Frequency-quadrupling Microwave Photonic Phase Shifter based on Dual-polarization MZM, Peng Yang¹; ¹Inner Mongolia Univ., China. A new microwave photonic phase shifter based on polarization modulation with capability of frequency quadrupling is proposed and analyzed in this paper

Su4E.4 • 17:45

A Novel Scheme for Photonic Generation of Broadly Tunable Radio Frequency Signals, Youxi Lu¹, Fei Wang¹, Jun Gu¹, Lun Shi¹, Mengmeng Peng¹, Chang-Hee Lee²; ¹Chongqing Univ. of technology, China; ²Korea Advanced Inst. of Science and Technology, Korea. A novel scheme for photonic generation of broadly tunable radio frequency signals using a reflective semiconductor optical amplifier is demonstrated. The bandwidth of generated radio frequency signal ranges from 20 to 300 GHz.

18:30–21:30 Banquet & Awards Ceremony, Garden Grand Ballroom (1F)

Dahlia, Track 5

Napoleon, Track 6

Louis XIII, Track 7

Marigold, Track 8

Bauhinia, Track 3

Su4F.3 • 17:30

Experimental Realization of Zero-Refractive-Index Lens with Ultralow Spherical Aberration, Xin-Tao He¹, Zhi-Zhen Huang¹, Jun-Cong She¹, Jian-Wen Dong¹; ¹Sun Yat-sen Univ., China. We experimentally demonstrate the all-dielectric zero-index photonic crystal on silicon chip, which is functionalized by a plane-concave lens with photonic Dirac cone at near-infrared wavelength.

Su4G.3 • 17:30

Efficient Ambipolar Organic Light-Emitting Transistors Based on 2-Phenyl-Tetracene with Orange Light Emission, Hou Changtao^{1,2}, Xu Wenjun³, Zhou Hang¹, Zhaoyu Zhang²; ¹School of Electronic and Computer Engineering, Shenzhen Graduate School, China; ²School of Science and Engineering, the Chinese Univ. of Hong Kong (Shenzhen), China; ³School of Advanced Materials, China. We employ a novel tetracene derivative, 2-phenyl-tetracene (Ph-TET), as the organic light-emitting transistors' emission material and OLETs show good optical and electronic properties with orange light.

Su4H.3 • 17:30

MWCNT@BiVO₄ for water solar splitting, Eser M. Akinoglu¹, Michael Giersig^{1,2}; ¹International Academy of Optoelectronics at Zhaoqing, South China Normal Univ., China; ²Dept. of Physics, Freie Universität Berlin, Germany. MWCNT@BiVO₄ system for water solar splitting are demonstrated. The high aspect ratio of this nanocomposite structures may assist to overcome the limitations arising from the competition between light absorption for charge carrier generation, and the charge carrier recombination due to the material's charge carrier diffusion length.

Su4H.4 • 17:45

Defective graphene-hBN heterostructures in giant near-field heat transfer, Kezhang Shi¹, Fanglin Bao², Sailing He¹; ¹Zhejiang Univ., China; ²South China Normal Univ., China. Recently we found multilayer graphene-hBN heterostructures can exceed the blackbody limit significantly in the near field heat transfer. In this paper we analyzed the influences of defects in those structures.

Su4I.3 • 17:30

Wide-field photoacoustic-computed microscopy, Bowen Jiang¹, Xiaoquan Yang², Xiangping Li¹, yaoyu cao¹; ¹Jinan Univ., China; ²Huazhong Univ. of Sci. & Tech., China. We developed a new method for photoacoustic-computed microscopy using strip illumination. The method is capable of mapping wide-field absorption distribution with dramatically improved speed.

Su4I.4 • 17:45

Real-Time Thermoacoustic Imaging System, Zhong Ji¹; ¹South China Normal Univ., China. This article reports a real-time thermoacoustic imaging system for breast cancer screening. The experimental results show that it realizes the fast three-dimensional thermoacoustic imaging, therefore it has the potential to become a routine breast screening method.

Su4K.4 • 17:15

Two-terminal Al_{0.1}Ga_{0.9}N/GaN based visible-blind avalanche phototransistors, Yanghui Ou¹; ¹Sun Yat-sen Univ., China. Two-terminal GaN/Al_{0.1}Ga_{0.9}N based avalanche phototransistors have been fabricated and characterized. The devices exhibit peak responsivity at 335 nm and optical gain of 3.6×10⁴ at 53.5 V, providing feasibility in realizing high-sensitive visible-blind detection.

Su4K.5 • 17:30

In_{0.16}Ga_{0.84}N Metal-Semiconductor-Metal Visible-light Photodiodes with GaN Interlayers deposited by Pulsed NH₃, Hongxia Wang¹; ¹Sun Yat-Sen Univ., China. GaN interlayers deposited with pulsed NH₃ flow were inserted into the In_{0.16}Ga_{0.84}N active layer to suppress phase separation. The then fabricated metal-semiconductor-metal visible-light photodiode exhibit the significantly decreased dark current and sharpened response cutoff.

Su4K.6 • 17:45

InP-Based Photodetectors with Wide Spectral Range and Low Dark Current for Optical Interconnection, Xiaokai Ma¹, Yongqing Huang¹, Jiarui Fei¹, Qingtao Chen¹, Tao Liu¹, Gongqing Li¹, Xiaofeng Duan¹, Kai Liu¹, Shiwei Cai¹, Xiaomin Ren¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China. By introducing p⁺-InAlAs layer and InGaAsP intrinsic layer, an InP-based p-i-n photodetector with wide spectral range and low dark current is fabricated. The responsivity is 0.45A/W and 0.41A/W respectively at 850nm and 1550nm wavelengths.

18:30–21:30 Banquet & Adwards Ceremony, Garden Grand Ballroom (1F)

Magnolia, Track 1

Hydrangea, Track 2

Hibiscus, Track 2

Begonia, Track 3

Orchid, Track 4

08:00–16:00 Registration, Garden Hotel Lobby (1F)

08:30–10:15

M1A • High Power Fiber Laser & New Amplifier Technologies I

President: Pu Zhou; National Univ of Defense Technology, China

08:30–10:30

M1B • Space Division Multiplexing

President: Songnian Fu; Huazhong Univ of Science & Technology, China

08:30–10:30

M1C • Data Center Networks

President: Bowen Chen; Soochow Univ, China

08:30–10:30

M1D • Active III-V Devices

President: Xinlun Cai; Sun Yat-Sen Univ, China

08:30–10:30

M1E • Microwave Photonics Based Signal Generation

President: Xiaoxiao Xue; Tsinghua Univ, China

M1A.1 • 08:30

Highly-stable 20/400 Yb-doped Large-mode-area Fiber with 3kW Laser Output Power, Ying Y. Wang¹, Kun Peng¹, Huan Zhan¹, Shuang Liu¹, Yuwei Li¹, Cong Gao¹, Li Ni¹, Xiaolong Wang¹, Lihua Zhang¹, Juan Yu¹, Lei Jiang¹, Jianjun Wang¹, Feng Jing¹, Aoxiang Lin¹; ¹China Academy of Engineering Physics, China. We report on a 3kW-level 20/400 Yb-doped aluminophosphosilicate fiber with ultra-low photodarkening and mode instability. The fiber laser was kept at ~2.1kW output for over 500 minutes with power degradation less than 1.1%.

M1A.2 • 08:45 **Invited**

Advanced Specialty Fiber Processing Methods for Fiber Laser and Sensing Applications, Baishi Wang¹; ¹Vytran Corporation, USA. We will present latest advance in specialty fiber processing technologies, which are used in fabrication of fused fiber components, power scaling of high power fiber lasers, and fiber sensing especially biophotonics fiber-based probe applications.

M1B.1 • 08:30 **Invited**

Beam-forming Space-division Multiplexing Transmission, Haoshuo Chen¹; ¹Nokia Bell Labs, USA. Single-ended fiber transfer matrix measurements are enabled employing spatial pilots, which differentiate different spatial and polarization modes using end reflections. We measure transfer matrices of single-mode and multimode fibers and realize transmitter-side MIMO preprocessing for beam-forming transmission.

M1C.1 • 08:30 **Invited**

Recent Research in Intra/Inter-data Center Network Communication, Shuangyi Yan¹; ¹Univ. of Bristol, UK. In this talk, optical switching technologies will be reviewed for possible deployments in data center networks. Recent research in intra/inter DCN, such as DCN architecture and experimental demonstrations, will be summarized.

M1D.1 • 08:30 **Invited**

Semiconductor Lasers with New Device Concepts, Weihua Guo¹; ¹Wuhan national lab. for optoelec. HUST, China. Multi-channel interference widely tunable lasers will be introduced. Two-section DFB lasers with high direct modulation bandwidth and grating-assisted microcylinder surface-emitting laser will be introduced as well.

M1E.1 • 08:30 **Invited**

Output Power Enhancement in Photonic-based RF Generation by Optical Pulse Compression with a Constant Dispersion Fiber, Takashi Yamaguchi¹, Hiroyuki Toda¹; ¹Doshisha Univ., Japan. We present the photonic-based RF generation with optical pulse compression in constant dispersion optical fiber in order to enhance the RF output power. Simulation results reveal the requirement for 100-GHz and 300-GHz RF generations.

08:00–16:00 Registration, Garden Hotel Lobby (1F)

08:30–10:15

M1F • Photonic Crystal

President: Ebrahim Karimi; Univ. of Ottawa, Canada

08:30–10:30

M1G • Visible Light Communications

President: Changyuan Yu, Hong Kong Polytechnic University, China

08:30–10:30

M1H • Performance Monitoring

President: Ming Tang; Huazhong Univ of Science and Technology, China

08:30–10:15

M1I • Advanced Optical Diagnostic Technologies V

President: Yueqing Gu; China Pharmaceutical Univ., China

08:30–10:15

M1J • SDM Fiber and Device Technologies III

President: Takemi Hasegawa; Sumitomo Electric Industries Ltd, Japan

M1F.1 • 08:30 **Invited**

Robust CMOS Compatible Photonic Crystal Nanocavity and DEMUX Filter, Takasumi Tanabe¹, Yuta Ooka¹, Nurul Ashikin Binti Daud¹, Tomohiro Tetsumoto¹; ¹Keio Univ., Japan. We photolithographically fabricate a high-Q photonic-crystal nanocavity with a silicon dioxide clad structure and demonstrate an electro-optic modulator, a photoreceiver, and a DEMUX, all of which are easy to integrate with other silicon photonic devices.

M1G.1 • 08:30

Demonstration of Optical Network Coding Transmission for Indoor Wireless Optical Communication, Jiankun Zhang¹, Anhong Dang¹; ¹Peking Univ., China. A network coding approach for indoor wireless optical communication is proposed and experimentally demonstrated, both in point-to-point scenario and multiuser case. Results show the scheme could support network communications under link loss and random occlusion.

M1G.2 • 08:45

Experimental Demonstration of Clipping Noise Mitigation for OFDM-Based Underwater Optical Wireless Communications, Chao Li¹, Zhengyuan Xu¹, Chao Yang², Qi Yang², Shaohua Yu²; ¹USTC, China; ²WRI, China. In this paper, we experimentally demonstrate the reduction of clipping noise for an OFDM-based underwater optical wireless communication (UOWC) system using decision-aided reconstruction (DAR). 2 dB SNR gain is successfully achieved for optical OFDM M-QAM signals.

M1H.1 • 08:30

Optical Performance Monitoring of 56Gbps Optical PAM4 Signal Using Artificial Neural Network, Yuanxiang Chen¹, Yongtao Huang¹, Jianguo Yu¹; ¹Beijing Univ. of Posts and Telecommunications, China. Artificial neural network model trained with eye diagrams parameters is developed for optical performance monitoring of PAM4 signal. The simulation results shows that the developed ANN models can simultaneously identify optical signal-to-noise ratio, chromatic dispersion, and differential group delay of 56Gbps optical PAM4 signal.

M1H.2 • 08:45

Modulation format identification Based on PCA and ADTS in Optical Communication, Jiadelaguli Biekeshutan¹; ¹Univ. of Science & Technology Beijing, China. We realize the identification of commonly-used modulation formats including 4QAM, 16QAM and 64QAM by mainly using the principal component analysis (PCA) and asynchronous delay-tap sampling (ADTS)

M1I.1 • 08:30 **Invited**

High Spatiotemporal Resolution Biomedical Imaging and Visualization, Hongen Liao¹, Zhencheng Fan¹, Xinran Zhang¹; ¹Tsinghua Univ., China. We develop imaging and visualization techniques for the acquisition of biomedical information with high spatial or temporal resolution. Further applications on super long viewing distance 3D autostereoscopic display and clinical theranostics are also discussed.

M1J.1 • 08:30 **Invited**

Recent Progress of Multi-core Fiber Technologies, Taiji Sakamoto¹, Takashi Matsui¹, Takashi Yamamoto¹, Kyoza Tsujikawa¹, Kazuhide Nakajima¹; ¹NTT access network service systems lab., Japan. We briefly review the recent progress of the technologies for uncoupled/coupled single-mode/few-mode multi-core fiber, and discuss its unique property and advantage as a transmission media used in the space division multiplexed system.

Magnolia, Track 1

M1A.3 • 09:15

6kW GTWave Fiber Amplifier, Huan Zhan¹, Kun Peng¹, Yuying Wang¹, Xiaolong Wang¹, Li Ni¹, Shuang Liu¹, Yuwei Li¹, Juan Yu¹, Lei Jiang¹, Jianjun Wang¹, Feng Jing¹, Aoxiang Lin¹; ¹China Academy of Engineering Physics, China. We fabricated and reported a GTWave fiber amplifier that allowed for 8.43 kW aggregated pump power. GTWave fiber presented 6 kW laser output with optical-to-optical efficiency of 69.8% without any evidence of roll-over.

M1A.4 • 09:30

A kilo-Watt all-fiber distributed-counter-pumping oscillator, Hanyuan Ying¹, Jianqiu Cao¹, Heng Chen¹, Yankun Ren¹, Zefeng Wang¹, Jinbao Chen¹; ¹National Univ of Defense Technology, China. A 1-kW all-fiber distributed-counter-pumping oscillator is demonstrated firstly to the best of our knowledge. The output power of 1.08 kW with a slope efficiency of 66% is obtained.

Hydrangea, Track 2

M1B.2 • 09:00

Measurement of Mode Coupling in Six-Mode Fiber for Mode-Division Multiplexing System, Feng Liu¹, Guijun Hu¹, Weicheng Chen¹, Cuiguang Chen¹; ¹Jilin Univ., China. We demonstrate the nondestructive measurement of mode coupling along 6-mode fiber using experimental setup with structure of a mode transverter, a mode demultiplexer and an FMF circulator. The distributions of mode coupling in 6-mode fiber between modes are successfully measured.

M1B.3 • 09:15

Experimental Demonstration of MMF Fundamental-mode MMF Transmission Enabled by Mode Conversion, Zhongying Wu¹, Juhao Li¹, Jinlgong Zhu¹, Yu Yang¹, Yingchao Xin¹, Yichi Zhang², Zhengbin Li¹, Zhangyuan Chen¹, Yongqi He¹; ¹Peking Univ., China; ²Wuhan Research Inst. of Posts and Telecommunications, China. We design and fabricate all-fiber mode-selective coupler (MSC) to excite fundamental mode of MMF, based on which, we experimentally demonstrate fundamental-mode transmission over 20-km OM3. The proposed scheme is experimentally compared with center-launching method.

M1B.4 • 09:30

MDM Transmission of Orbital Angular Momentum (OAM) Modes in a 2.6-km Conventional Graded-Index Multimode Fiber Assisted by All-Fiber Mode Selective Couplers, Lulu Wang^{1,3}, Yan Luo^{1,3}, Wei Zhou^{1,3}, Long Zhu¹, Andong Wang¹, Cheng Du², Qi Mo², Jian Wang¹; ¹Wuhan National Lab. for Optoelectronics, China; ²Fiberhome Telecommunication Technologies, China; ³Shenzhen Inst. of Huazhong Univ. of Science and Technology, China. We demonstrate mode-division multiplexing (MDM) using all-fiber mode selective couplers (MSCs). Two data-carrying orbital angular momentum (OAM) modes are successfully (de)multiplexed and transmitted over 2.6-km conventional graded-index multimode fiber (MMF).

Hibiscus, Track 2

M1C.2 • 09:00

Topology-aware Virtual Machine Placement in Optical switching based Small-world Datacenter Networks, Tong Chang¹, cen wang¹, yinan tang¹, Hongxiang Guo¹, Jian Wu¹; ¹BUCT, China. This paper proposed a heuristic topology-aware virtual machine placement algorithm for optical small-world datacenter networks. Simulation results verify its effectiveness in terms of improving network performance.

M1C.3 • 09:15

Service Chain Placement in Server-centric Optical Datacenter Networks, Yi Yang¹, Jijia Chen^{1,2}; ¹ZJU-SCNU Joint Research Center of Photonics, South China Normal Univ., China; ²KTH Royal Inst. of Technology, School of ICT, Sweden. We propose and compare several heuristics service chain (SC) placement algorithms tailored for the server-centric optical interconnect architecture, providing a guideline on how to efficiently place SCs in such an optical datacenter network.

M1C.4 • 09:30

Heatsink topology based optical interconnect for datacenters, Bing Yang¹, Yu Gong², Xuezhi Hong¹, Jijia Chen^{1,3}; ¹ZJU-SCNU Joint Research Center of Photonics, South China Normal Univ., China; ²Centre for Optical and Electromagnetic Research, Zhejiang Univ., China; ³KTH Royal Inst. of Technology, School of ICT, Sweden. We propose an optical interconnect architecture based on heatsink topology to enhance reliability for large-scale datacenters. The experimental demonstration has been carried out to verify the transmission performance of the proposed architecture.

Begonia, Track 3

M1D.2 • 09:00

Hybrid Square-Rectangular Bistable Laser for Fast Low-Power All-Optical Flip-Flop, Yue-De Yang¹, Xiu-Wen Ma¹, Jin-Long Xiao¹, Yong-Zhen Huang¹; ¹Inst. of Semiconductors, CAS, China. We have demonstrated fast low-power all-optical flip-flop based on robust hybrid square-rectangular bistable laser. The average optical switching energy is 8.5 fJ and the set-reset response times are about 165 and 60 ps.

M1D.3 • 09:15

Thermal Analysis of Ultra-broadband Lasing InAs/InP Quantum-dash Lasers, Emad Alkharaji^{1,2}, Muhammad Talal Ali Khan², Mohamed Shemis², Mohammed Zahed Mustafa Khan²; ¹Jubail Industrial College, Saudi Arabia; ²Electrical Engineering Dept., King Fahd Univ. of Petroleum and Minerals, Saudi Arabia. Thermal analysis of InAs/InP quantum-dash lasers revealed ~6(45)°C/W thermal resistance value for 15(2)µm ridge-width devices, thus exhibiting an inverse relationship. This further affirms thermionic emission process being responsible for enhanced lasing-bandwidth for narrow ridge-width devices.

M1D.4 • 09:30

Novel Linewidth Narrowing Scheme of DFB Lasers Based on Integrated Mutual Injection Locking, Weichao Ma¹, Bing Xiong¹, Xu Ke¹, Changzheng Sun¹, Yi Luo¹, Zhibiao Hao¹, Jian Wang¹, Yanjun Han¹, Lai Wang¹, Hongtao Li¹; ¹Tsinghua Univ., China. A novel linewidth narrowing scheme based on mutual injection locking is proposed and experimentally confirmed. Narrowing factor of 2~4 is demonstrated for monolithic DFB lasers, together with enhanced output power and suppressed relative intensity noise.

Orchid, Track 4

M1E.2 • 09:00 Invited

Tunability and Reconfigurability along Microwave Photonics Links, Jia Ye¹, Lianshan Yan¹, Hengyun Jiang¹, Zhiyu Chen¹, Xihua Zou¹, Wei Pan¹, Bin Luo¹; ¹Southwest Jiaotong University, China. Certain impairments exist along dynamic microwave photonics links. Tunability of signal generation and reconfigurable mitigation schemes are essential for the mitigation of performance degradations. Recent demonstrations will be reviewed and discussed.

M1E.3 • 09:30

High Isolation and Ultra-wideband TR Module Based on Microwave Photonic Technology, Hui Gao^{1,2}, Yi Wang¹, Ye Deng^{1,2}, Jin P. Zhang^{1,2}, Zhi P. Zhou^{1,2}; ¹Nanjing Research Inst. of Electronics Technology, China; ²Science and Technology on Antenna and Microwave Laboratory, China. A novel TR module realized by microwave photonic technology which could transmit and receive simultaneously was reported. This system had the advantages of real-time adjustability, simplicity. The isolation degrees which were higher than 35dB in the frequency range of 6GHz~18GHz had been successfully achieved.

Dahlia, Track 5

M1F.2 • 09:00 **Invited**
Nonlinear Photonic Metamaterials and Geometric Berry Phase, Shumei Chen¹, Guixin Li², Thomas Zentgraf³, Shuang Zhang¹; ¹*School of Physics and Astronomy, Univ. of Birmingham, UK*; ²*Dept. of Materials Science and Engineering, Southern Univ. of Science and Technology, China*; ³*Dept. of Physics, Univ. of Paderborn, Germany*. We study the nonlinear geometrical Berry phase in third harmonic generation (THG) process for the first time by using ultrathin metasurface consisting of spatial variant plasmonic nanostructures

M1F.3 • 09:30
General effective medium design of efficient planar photonic crystal absorbers in visible region, Chang Liu¹, Yumin Liu¹; ¹*Beijing Univ of Posts & Telecom, China*. We propose a general strategy to design planar absorber of excellent absorbing performance using effective medium theory. The method we used can be very useful for the design of planar broadband absorber.

Napoleon, Track 2

M1G.3 • 09:00
Performance Enhancement of a Nonlinear VLC System Using Carrier Interferometry OFDM (CI-OFDM), Jiemei Wang¹, Chao Li¹, Zhengyuan Xu^{1,2}; ¹*USTC, China*; ²*Shenzhen Graduate School, Tsinghua Univ., China*. We experimentally demonstrate a performance enhancement scheme for a nonlinear visible light communication (VLC) system using carrier interferometry OFDM (CI-OFDM). Compared with conventional OFDM, 2dB SNR improvement is successfully achieved in the nonlinear modulation region.

M1G.4 • 09:15
Demonstration of Real-Time CAP Transceivers with Hybrid Digital Equalization for Visible Light Communication, Yanfeng Mao¹, Xianqing Jin¹, Weijie Liu¹, Chen Gong¹, Zhengyuan Xu¹; ¹*Univ. of Science and Technology of China, China*. Real-time carrierless amplitude-phase (CAP) transceivers with hybrid linear/DFE equalization are designed and demonstrated for VLC systems for the first time, which shows a significant improvement in EVM performance of 200Mb/s CAP transmission over 15m.

M1G.5 • 09:30
Location-based Equalization for OFDM Indoor Visible Light Communication Systems, Xiaodi You¹, Jian Chen¹, Changyuan Yu²; ¹*Nanjing Univ. of Posts & Telecomm., China*; ²*The Hong Kong Polytechnic Univ., China*. In indoor OFDM VLC, we propose a location-based equalization (LBE) concept to alleviate multi-path effects. The LBE design, especially based on a LOS link, can effectively equalize OFDM multi-path signals and improve system BER performance.

Louis XIII, Track 2

M1H.3 • 09:00
Modulation Format Identification for Square M-QAM Signals by Using a Neural Network, Jong-wan Kim¹, Chang-Hee Lee^{1,2}; ¹*KAIST, Korea*; ²*Chongqing Univ. of technology, China*. We propose a modulation format identification method for square M-QAM signals in EON by using a neural network without pre-defined threshold value. We demonstrate identification of QPSK, 16-QAM, 64-QAM formats with a 3 layers neural network.

M1H.4 • 09:15
CAZAC Sequence Based In-Band OSNR Monitoring for DP-CO-OFDM system, Qiong Wu¹, Yating Xiang¹, Ming Tang¹, Songnian Fu¹, Deming Liu¹; ¹*Huazhong Univ. of Sci&Tech (HUST), China*. A CAZAC sequence based in-band OSNR monitoring technique was proposed and demonstrated with estimation error less than 0.5dB for both polarizations in a dynamic range of 12~30dB for 90.91Gb/s 16QAM-DP-CO-OFDM transmission.

M1H.5 • 09:30 **Invited**
Techniques for Performance Evaluation of Optical Transmission System and Module, Kang Ping Zhong¹, Changjian Guo¹, Aadil Raza¹, Xian Zhou¹, Jiahao Huo¹, Alan Pak Tao Lau¹, CHAO LU¹; ¹*The Hong Kong Polytechnic Univ., China*. In this paper, we discuss techniques for performance evaluation of optical transmission system and module, including short reach IM/DD transmission system and coherent transmission systems.

Marigold, Track 8

M1I.2 • 09:00 **Invited**
Optical Mapping of Brain Activity Underlying Translation Asymmetry during Chinese/English Sight Translation, Zhen Yuan¹; ¹*Faculty of Health Sciences, Univ. of Macau, China*. The present brain mapping techniques are insufficient to reveal the neural mechanism underlying translation asymmetry. In this study, the optical neuroimaging technique was used to extract the brain activation patterns associated with Chinese/English sight translation.

M1I.3 • 09:30 **Invited**
Monitoring blood flow dynamics in dorsal skinfold window chamber model during vascular targeted photodynamic therapy, Buhong Li¹; ¹*Fujian Normal Univ., China*. Photodynamic therapy for vascular occlusion in dorsal skinfold window chamber model was performed to elucidate the mechanisms of vascular targeted PDT, and laser speckle imaging was used to monitor the blood flow dynamics during treatment.

Bauhinia, Track 1

M1J.2 • 09:00
Parallel transmission loops for MCF system investigations, Benjamin J. Puttnam¹, Ruben S. Luis¹, Georg Rademacher¹, Yoshinari Awaji¹, Naoya Wada¹; ¹*National Inst Info & Comm Tech (NICT), Japan*. We describe a triple synchronized transmission loop set-up to investigation of joint-modulation and shared processing in multi-core fiber transmission. We discuss the impact of inter-core skew and demonstrate large reach advantages using coded multi-core modulation.

M1J.3 • 09:15
A Technique for Simultaneous Measurement of Differential Group Delay of Each Core in a Multicore Fiber, Ryuki Miyazaki¹, Masaharu Ohashi¹, Hirokazu Kubota¹, Yuji Miyoshi¹, Nori Shibata²; ¹*Osaka Prefecture Univ., Japan*; ²*College of Engineering, Nihon Univ., Japan*. We propose a technique to simultaneously measure the differential group delay (DGD) between the LP₀₁ and LP₁₁ modes of each core in few-mode multicore fibers (FM-MCFs).

M1J.4 • 09:30 **Invited**
Multimode and Multi-core Fiber Amplifiers for Space-division Multiplexed Communications Systems, Nicolas K. Fontaine¹, Haoshuo Chen¹, Roland Ryf¹, Juan Carlos Alvarado-Zacarias², Zeinab Sanjabi Eznaveh², Jose Enrique Antonio-Lopez², Rodrigo Amezcua Correa²; ¹*Nokia Corporation, USA*; ²*CREOL, Univ. of Central Florida, USA*. Multimode and multi-core fiber amplifiers must exhibit low mode dependent gain, and produce large output powers per mode (20-dBm) with low noise figures. To be cost competitive, they must have less complexity than an array of single-mode fiber amplifiers. We will discuss several amplifier designs to improve these metrics.

Magnolia, Track 1

M1A.5 • 09:45
Wavelength swept fiber laser source based on recirculating optical time-stretch, Minggui Wan¹, Xudong Wang¹, Yuan Cao¹, Xinhuan Feng¹, Bai-ou Guan¹; ¹*Jinan Univ., China*. We propose and successfully demonstrate a wavelength-swept fiber laser source based on recirculating optical time-stretch of an actively mode-locked fiber laser. It has the advantages of simple configuration and switchable duration of wavelength-swept pulses.

M1A.6 • 10:00
Pulsed random Raman fiber laser under ultra-short pulse pumping, Weiwei Pan¹, Lei Zhang¹, Huawei Jiang¹, Xuezhong Yang¹, Shuzhen Cui¹, Yan Feng¹; ¹*Shanghai Inst. Optics & Fine Mechanics., China*. We report a pulsed random Raman fiber laser under ultrashort pulse pumping. With compound cavities based on distributed Rayleigh scattering, picosecond pulses at 1120 nm with pulse energy up to 6 nJ are obtained.

Hydrangea, Track 2

M1B.5 • 09:45
Core Mode Scramblers for ML-detection based Multi-Core Fibers Transmission, Akram A. Abouseif¹, Ghaya R. Ben-Othman¹, Yves Jaouen¹; ¹*LTCL, Telecom paristech, France*. We investigate the performance of Heterogeneous Multi-Core Fiber communication systems. We define the Core Dependent Loss (CDL) as a result of both crosstalk and misalignment. We propose random core scrambling to mitigate the CDL and so enhance the system performance.

M1B.6 • 10:00
PDM-128-QAM Transmission Using Shared Carrier Reception in a 7-Core Multi-Core Fiber, Ruben S. Luis¹, Benjamin Puttnam¹, Georg Rademacher¹, Yoshinari Awaji¹, Naoya Wada¹; ¹*National Inst Information & Comm Tech, Japan*. We demonstrate longer than 200-km transmission of 20~GBaud PDM-128-QAM signals on a 7-core multi-core fiber using shared-carrier reception method.

M1B.7 • 10:15
Impact of Crosstalk-Power and -Polarization Variations on Short-Haul Multi-Core Fiber Transmission Systems, Georg Rademacher¹, Ruben S. Luis¹, Benjamin Puttnam¹, Yoshinari Awaji¹, Naoya Wada¹; ¹*National Inst of Information & Comm Tech, Japan*. We experimentally investigate crosstalk-power and -polarization variations in direct-detection transmission systems with homogeneous multi-core fibers. We find a strongly fluctuating performance that needs to be taken into account for the design of such systems.

Hibiscus, Track 2

M1C.5 • 09:45
Modulation-Level-Awared Multicast Flow Aggregation Scheme in Elastic Optical Datacenter Networks, Lu Zhang¹, Xin Li¹, Ying Tang¹, Tao Gao¹, Bingli Guo¹, Shanguo Huang¹; ¹*Beijing Univ. of Post and Telecommu, China*. A modulation-level-awared multicast flow aggregation (MLA-MFA) scheme which aggregates multicast services according to the highest and lowest available modulation-levels is proposed. Simulations show that the MLA-MFA scheme can effectively reduce network cost.

M1C.6 • 10:00
Topology-Adaptive Reconfigurable Network with Optical Circuit Switch for HPC Systems, Yu Shang¹, Bingli Guo¹, Wenzhe Li¹, Tao Gao¹, Yu Zhou¹, Xin Li¹, Shanguo Huang¹; ¹*BUPT, China*. We propose a topology-adaptive hybrid packet/circuit network using optical circuit switches for HPC systems. The dynamically reconfigured topologies according to traffic patterns achieve low end-to-end latency and high throughput.

M1C.7 • 10:15
Reconfigurable all-fiber pre and post mode exchange for short-reach MDM networks, Zhongying Wu¹, Juhao Li¹, Dawei Ge¹, Junchi Jia¹, Muqing Zhou¹, Yu Tian¹, Yichi Zhang², Zhengbin Li¹, Zhangyuan Chen¹, Yongqi He¹; ¹*Peking Univ., China*; ²*Wuhan Research Inst. of Posts and Telecommunications, China*. We experimentally demonstrate reconfigurable all-fiber pre and post mode exchange for short-reach mode division multiplexing (MDM) networks, in which mechanically induced long period fiber grating (LPGF) is utilized to swap modes in few-mode fiber (FMF).

Begonia, Track 3

M1D.5 • 09:45
Noise Reduction of Integrated Laser Source with On-Chip Optical Feedback, Bowen Song^{1,2}, Keisuke Kojima², Sergio Pinna¹, Toshiaki Koike-Akino², Bingnan Wang², Jonathan Klamkin¹; ¹*Univ. of California Santa Barbara, USA*; ²*Mitsubishi Electric Research Laboratories, USA*. Integrated indium phosphide distributed Bragg reflector lasers with on-chip optical feedback were realized and demonstrate a side-mode-suppression-ratio of 45 dB, sub-megahertz laser linewidth and an order of magnitude peak relative intensity noise reduction.

M1D.6 • 10:00 **Invited**
Quantum-Dot-Based Advanced Photonic Devices and Its Applications, Atsushi Matsumoto¹, Kouichi Akahane¹, Toshimasa Umezawa¹, Tomohiro Kita², Katsuyuki Utaka³, Naokatsu Yamamoto¹; ¹*NICT, Japan*; ²*Tohoku Univ., Japan*; ³*Waseda Univ., Japan*. Quantum dot (QD) is one of the attractive materials. In this paper, we focus on advanced photonic devices using QD structure and its applications for the next generation access networks.

Orchid, Track 4

M1E.4 • 09:45
Reconfigurable Microwave Photonic System for Linearly Chirped Microwave Waveform Generation and Pulse Compression, Chunqi Song¹, Xinlu Gao¹, Mingyang Zhao¹, Shanguo Huang¹; ¹*Beijing Univ. of Posts and Telecom, China*. A reconfigurable microwave photonic system for linearly chirped microwave waveform generation and pulse compression is proposed and simulated. A pulse compression with a compression ratio of 29 is implemented.

M1E.5 • 10:00
Arbitrary Microwave Signal Generator based on an Optoelectronic Oscillator and Time-Domain Processing, Yuejiao Zi¹, Yang Jiang², Jing Tian², Yutong He², Yi Xia², Xiaoyu Zhang²; ¹*College of Big Data and Information Engineering, Guizhou Univ., China*; ²*College of Physics, Guizhou Univ., China*. Due to an optoelectronic oscillator and time-domain processing, a microwave signal generator, which can output sine, square, triangle and sawtooth, is proposed and experimentally demonstrated. It show low cost, transparent to wavelength and large bandwidth.

M1E.6 • 10:15
Generation of Frequency-Tripled Binary Phase-Coded Microwave Signals Using a DP-QPSK Modulator, Yang Chen¹, Shilong Pan²; ¹*School of Information Science and Technology, East China Normal Univ., China*; ²*Key Laboratory of Radar Imaging and Microwave Photonics, Ministry of Education, Nanjing Univ. of Aeronautics and Astronautics, China*. A novel frequency-tripled binary phase-coded microwave signal generation approach using a quadrature phase shift-keying modulator is proposed and demonstrated. A 9.99 GHz or 15.9 GHz phase-coded microwave signal is generated using a 3.33 GHz or 5.3 GHz reference signal. The phase recovery and pulse compression performance is also evaluated.

10:30–11:00 Coffee Break and Exhibition, Corridor 3F and Exhibition Area

Dahlia, Track 5

M1F.4 • 09:45

Unidirectional propagation of light in valley photonic crystals by OAM excitation, Xiaodong Chen¹, Fu-Long Shi¹, Wei-Min Deng¹, Jin c. Lu¹, Jian-Wen Dong¹; ¹*Sun Yat-sen Univ., China*. In valley photonic crystals, we demonstrate the unidirectional propagation of bulk states by OAM sources, and also find the robust transport of valley-dependent edge states.

M1F.5 • 10:00

On-chip slotted photonic crystal nanobeam cavity for single nanoparticle trapping and detection, Daquan Yang¹, Fei Gao², Yun-Feng Xiao², Yuefeng Ji¹; ¹*Beijing Univ of Posts & Telecom, China*; ²*Peking Univ., China*. We design an on-chip slotted photonic-crystal nanobeam-cavity with ultra-high Q/V to enhance cavity optical trapping characteristic. For stable trapping a 10nm-radius polystyrene-nanoparticle, ultra-low threshold power of 0.165μW and ultra-high trapping force of 1.09×10⁴pN/mW can be achieved.

Napoleon, Track 2

M1G.6 • 09:45

High Spectrum Efficiency DFT-S OFDM Visible Light Communication based on Interleaved Allocation and Phase Reversal Coding and Hybrid Pre-equalization, Meng Shi¹, Xingyu Lu¹, Fumin Wang¹, Liang Qiao¹, Nan Chi¹; ¹*Dept. of Communication Science and Engineering, Fudan Univ., China*. A novel interleaved allocation, phase reversal coding and hybrid pre-equalization scheme is proposed in DFT-S OFDM VLC system. A 64QAM signal at 440M baud, 256QAM signal at 325M baud over 1-m transmission is experimentally demonstrated.

M1G.7 • 10:00

Real Time Transmission Technology of 610Mbps Visible Light Communication Utilizing Phosphor-based LED, Xiongbin Chen^{1,2}, Honglei Li³, chengyu Min¹; ¹*State Key Laboratory of Integrated Optoelectronics, Inst. of Semiconductor, Inst Semiconductors, CAS, China*; ²*School of Electronic, Electrical and Communication Engineering, Univ. of Chinese Academy of Sciences, China*; ³*Inst. of Semiconductors, Chinese Academy of Sciences, China*. The data rate of 610Mbps is experimentally achieved by 1 watt phosphor-based LED over 6.2 m with the BER of 2.0e-5. A 100Mbps optical internet access demo system over 3 m distance is demonstrated.

M1G.8 • 10:15

PAM-4 and PAM-8 transmission in Visible Light Communication system employing Volterra kernels based Feed Forward Equalizer, Wei Liu¹, Ying Shen¹, Shanhong You¹, Ying Wang¹, Zhen Wang¹, Xiang Li², Ming Luo²; ¹*Soochow Univ., China*; ²*Wuhan Research Inst. of Posts & Telecommunications, China*. Volterra kernels based channel equalizer is experimentally demonstrated to mitigate the nonlinearity in visible light communication system. We also simplify the Volterra algorithm and find a trade-off between the transmission performance and the computational complexity.

Louis XIII, Track 2

M1H.6 • 10:00

Enhanced Blind Modulation Format Identification in Stokes Space Utilizing Adaptive Clustering Algorithm, Dehe Chen¹, Zejie Cai¹, Shuxin Chen¹; ¹*Sun Yat-Sen Univ., China*. A Stokes-space based modulation format identification technique is proposed for coherent optical receivers using adaptive clustering algorithms. Successful identification can be realized among five different modulation formats in dual-polarization optical fiber systems.

M1H.7 • 10:15

A Large Dynamic Range and Polarization Independent Coherent OTDR Scheme, Ke Yan¹, Tao Yang¹, Liqian Wang¹, Zhiliang Ren², Sheping Shi², Yan Zhao¹, Yan Zhang¹, Xue Chen¹; ¹*Beijing Univ. of Posts and Telecommunications, China*; ²*ZTE, China*. A novel polarization independent scheme, based on 3×3 coupler coherent detection with dynamic range of 50 dB, is proposed to solve the problem of polarization dependence and obtain large dynamic range in OTDR.

Marigold, Track 8

M1I.4 • 10:00

Miniaturized Fiber Bundle Endoscope for Pre-Clinical Research, Shawn P. Casey¹, Kaijie Wu²; ¹*School of Pharmacy, Shanghai Jiao Tong Univ., China*; ²*School of Electronic Information and Electronic Engineering, Shanghai Jiao Tong Univ., China*. A miniaturized (<0.4mm), low-cost endoscope suitable for use in pre-clinical research is discussed. A fiber-optic image guide bonded to a GRIN type lens allows for both conventional and fluorescence imaging modalities.

Bauhinia, Track 1

M1J.5 • 10:00

DGD and Dispersion Measurement of Few Mode Fibres Based on Mode Excitation, Yaping Liu¹, Liyan Zhang¹, Lei Shen¹, Xueting Sun¹, Su Chen¹, Jing Li¹; ¹*yofc, China*. We measured differential group delay of some different kinds of few mode fibres and the dispersion of a Stepped-Index 4 mode few mode fibre around 1550nm through a phase-plate to excite different linear-polarization mode.

10:30–11:00 Coffee Break and Exhibition, Corridor 3F and Exhibition Area

Magnolia, Track 1

11:00–12:15
M2A • Optical Fiber Sensor, Device & Technology II
President: Pu Zhou; National Univ of Defense Technology, China

M2A.1 • 11:00 **Invited**
Fully Distributed Optical Fiber Sensors and Their Applications in SHM, Xuping Zhang^{1,2}, Yixin Zhang^{1,2}, Feng Wang¹, Mi Li¹; ¹Nanjing Univ., Inst. of Optical Communication Engineering, China; ²Nanjing Univ., Key Laboratory of Modern Acoustics, China. In this talk, a fully distributed fiber optical sensing system based on the combination of Brillouin and Rayleigh scattering light are developed. And the applications for the distributed fiber optical sensing system in SHM (structure health monitoring) are given. Vibration and stress on the detecting structure are identified and located by the designed system. The experimental results showed that the proposed system has an ability to monitor the structure health situation with high-fidelity.

Hydrangea, Track 2

11:00–12:30
M2B • Short Reach Systems II
President: Chao Lu; The Hong Kong Polytechnic Univ., China

M2B.1 • 11:00 **Tutorial**
The Kramers – Kronig Receiver, Antonio Mecozzi¹, Cristian Antonelli¹, Mark Shtaif²; ¹Universita degli Studi dell'Aquila, Italy; ²School of Electrical Engineering Dept. of Physical Electronics The Iby and Aladar Fleischman Faculty of Engineering, Tel Aviv Univ., Israel. The Kramers – Kronig receiver has been shown to offer unprecedented opportunities in the design of optical transceivers where the need of high performance is accompanied by that of reduced complexity and cost. We review the operation principles and the various implementations of the KK receiver, including a direct detection implementation in which the necessary CW tone is transmitted with the signal, and one in which it is added at the receiver and plays the role of the LO of coherent receivers.

Hibiscus, Track 2

11:00–12:30
M2C • Transmission Techniques I
President: Aazar Saadaat Kashi; Queen's Univ., Canada

M2C.1 • 11:00
Suppression of IQ Modulation Error Based on Single-Sideband Modulation to Generate Ultra-high Order QAM Optical Signals, Koji Igarashi¹; ¹Osaka Univ., Japan. We propose single-sideband modulation scheme for generating ultra-high order QAM optical signals. It can suppress BER degradation due to IQ modulation imbalance, although the modulation bandwidth twice the conventional IQ modulation is required.

M2C.2 • 11:15
Affine Projection Based Modified Constant Modulus Algorithm in CO-OFDM System, Wei Bao¹, Ling Liu¹, Jiafei Fang¹, Meihua Bi², Shilin Xiao¹; ¹Shanghai Jiao Tong Univ., China; ²Hangzhou Dianzi Univ., China. **Abstract:** A novel affine projection based modified constant modulus algorithm (AP-MCMA) for coherent optical orthogonal frequency division multiplexing (CO-OFDM) system is proposed in this paper. Simulation results demonstrate that a high convergence rate can be achieved.

Begonia, Track 3

11:00–12:15
M2D • Silicon Photonics II
President: Hon Tsang; Chinese Univ. of Hong Kong, China

M2D.1 • 11:00 **Invited**
Amplified Silicon Photonics, Andrew P. Knights¹; ¹McMaster Univ., Canada. This presentation will discuss amplified silicon photonics.

Orchid, Track 4

11:00–12:30
M2E • Applications in Radar Field
President: Lianshan Yan; Southwest Jiaotong Univ., China

M2E.1 • 11:00 **Invited**
High Precision Time and Frequency Transfer Over Fiber Links, Yi Dong¹; ¹Beijing Institute of Technology, China. This presentation will discuss high precision time and frequency transfer over fiber links.

Dahlia, Track 5

11:00–12:15

M2F • Micro/Nanophotonics I

Presider: Kevin Tsia; Univ. of Hong Kong, China

M2F.1 • 11:00 **Invited**

Quantum Cryptography with Structured Photons, Ebrahim Karimi¹; ¹Univ. of Ottawa, Canada. This presentation will discuss quantum cryptography with structured photons.

Napoleon, Track 2

11:00–12:30

M2G • Short Reach Systems III

Presider: Yoshinari Awaji; National Inst of Information & Comm Tech, Japan

M2G.1 • 11:00

Multiple-Band OFDM Transmission Exploiting the Frequency Chirping Properties of Silicon Ring-Resonator Modulators, Mohamed Essghair Chaibi¹, Olivier Dubray², Laurent Bramerie¹, Karim Hassan², Christophe Peucheret¹; ¹FOTON Laboratory, CNRS, Univ. of Rennes 1, France; ²Univ. Grenoble Alpes, CEA, LETI, MINATEC, France. The complementarity of the frequency responses of IM-DD channels for positive and negative detunings of ring-resonator modulators, obtained as a result of their chirping properties, is exploited to overcome frequency fading limitations in DD-OFDM systems.

M2G.2 • 11:15

Injection Locked triple Contact Fabry-Pérot Laser Diode for Uncooled WDM System, Myeonggyun Kye¹, Chang-Hee Lee^{1,2}; ¹Korea Advanced Inst. of Science and Technology, Korea; ²Chongqing Univ. of Technology, China. We propose an injection locked triple contact F-P LD for uncooled WDM system. Thanks to the mode tuning characteristics of TC F-P LD, we can optimize the detuning without using temperature control. We checked the quality of the output, and estimated receiver sensitivity focusing on using the source as a local oscillator in coherent system.

Louis XIII, Track 2

11:00–12:30

M2H • New Transmission and Networking Techniques

Presider: Jie Liu; Sun Yat-Sen Univ., China

M2H.1 • 11:00

Minimization of Crosstalk in Multicore Optical Fibre Link using Real-time FPGA-based Approach, Kibria Hasanuzzaman¹, Sandis Spolitis², Toms Salgals², Jānis Braunfelds², Alvaro Morales³, Luz E. González⁴, Rommel Simon³, Rafael Puerta³, Pablo Asensio³, Vjaceslavs Bobrovs², Stavros Iezekiel¹, Idelfonso Tafur Monroy⁵; ¹Univ. of Cyprus, Cyprus; ²Riga Technical Univ., Latvia; ³Technical Univ. of Denmark, Denmark; ⁴Universidad del Valle, Colombia; ⁵Technische Universiteit Eindhoven, Netherlands. We experimentally demonstrate pre-emphasis based performance for a 2 km long 7-core multicore fiber link. Simultaneous transmission below the FEC threshold is achievable for all cores by using signal equalization in a FPGA.

M2H.2 • 11:15

Random Degenerate Mode Mixing Independent OAM Mode-Group (De)multiplexing over a Graded-Index Ring-Core Fiber, Guoxuan Zhu¹, Xiong Wu¹, Jie Liu¹, Yujie Chen¹, Junwei Zhang¹, Jiangbo Zhu², Cheng Du³, Siyuan Yu^{2,1}; ¹Sun Yat-Sen Univ., China; ²Univ. of Bristol, UK; ³Fiberhome Telecommunication Technologies Co. Ltd, China. A mode-group (de)multiplexing scheme independent of random degenerate mode mixing in the fiber is proposed. Successful transmission of two multiplexed OAM MG over 1-km graded-index ring-core fiber is experimentally demonstrated by using this technique.

Marigold, Track 8

11:00–12:30

M2I • Nano Biophotonics for Imaging and Therapy

Presider: Buhong Li; Fujian Normal Univ., China

M2I.1 • 11:00 **Invited**

Laser-triggered photo-thermal nano-platform for controlled drug release and enhanced therapeutic efficacy, Yueqing Gu¹; ¹China Pharmaceutical Univ., China. This presentation will discuss laser-triggered photo-thermal nano-platform for controlled drug release and enhanced therapeutic efficacy.

Bauhinia, Track 1

11:00–12:30

M2J • Advanced Fiber and Fiber Devices II

Presider: Liangming Xiong; State Key Laboratory of OFCMT, YOFC, China

M2J.1 • 11:00 **Invited**

Universal Fiber for High Speed Data Centers, Xin Chen¹, Jason Hurley¹, Jeff Stone¹, Bruce Chow², Doug Coleman³, Ming-Jun Li¹; ¹Corning Research & Development Corp, USA; ²Corning Optical Fiber and Cable, Corning Incorporated, USA; ³Corning Optical Communications, LLC, USA. Universal fiber supports both multimode and single-mode transmission. We present the fiber design, system performance at 100G along with the benefit of using it in data center.

Magnolia, Track 1

M2A.2 • 11:30
High Precision Phase Sensitive Fiber-optic Gas Sensor Based on Dispersion Spectroscopy Using Frequency-Stabilized Optical Source, Ke Su¹, Xinyu Fan¹, Shuai Wang¹, Zuyuan He¹; ¹Shanghai Jiao Tong Univ., China. A novel fiber-optic gas sensor based on dispersion spectroscopy is proposed. With the fiber laser locked to the absorption line of HCN, a detection sensitivity of 47 part-per-billion×meter is achieved by using phase-sensitive heterodyne detection.

M2A.3 • 11:45
Simultaneous Multi-point Sensing through External Phase Modulation based Brillouin Optical Correlation Domain Analysis, Bhargav Somepalli¹, Deepa Venkitesh¹, Balaji Srinivasan¹; ¹Dept. of Electrical Engineering, Indian Inst. of Technology Madras, India. We propose and experimentally demonstrate a pathway for simultaneous multi-point sensing using Brillouin Optical Correlation Domain Analysis based on external phase modulation. Generation and independent tuning of two correlation peaks over 1 km fiber are demonstrated.

M2A.4 • 12:00
Microstructured Co²⁺-doped Fiber Bragg Grating for Microfluidic Velocity Sensing, Ying Li¹, Guofeng Yan¹, Sailing He¹; ¹Zhejiang Univ., China. A microstructured Co²⁺-doped fiber Bragg grating (MCFBG) for microfluidic velocity sensing was proposed and demonstrated theoretically. By tracking the wavelength and relative position of the phase-shift point, the temperature influence can also be compensated.

Hydrangea, Track 2

M2B.2 • 11:45
56-Gb/s Single-Photodiode 16QAM Transmission over 140-km SSMF Using Kramers-Kronig Detection, Shu Liang¹, Jianqiang Li¹, Zhiqian Wan¹, Yuting Fan¹, Feifei Yin¹, Yue Zhou¹, Yitang Dai¹, Kun Xu¹; ¹Beijing Univ. of Posts and Telecom., China. We experimentally demonstrate a 56-Gb/s single-photodiode 16QAM transmission using Kramers-Kronig detection over 140-km SSMF. The impacts of both CSPR and frequency shift of the co-propagating continuous wave tone are investigated to get the optimal performance.

M2B.3 • 12:00
Beyond 60 Gbps NRZ Transmission via a Band-Limited 850nm-VCSEL Link Based on Simplified-MLSE Algorithm, Zhongwei Tan¹, Chuanchuan Yang¹, Yixiao Zhu¹, Zhaopeng Xu¹, Xinyue Wang², Fan Zhang¹, Ziyu Wang¹; ¹Peking Univ., China; ²China Agricultural Univ., China. In this paper, we demonstrate 60 Gbps and 70 Gbps NRZ transmissions using an 18 GHz band-limited 850nm-VCSEL, based on a simplified-MLSE method, and investigate the complexity reduction of the algorithm in different data rates.

Hibiscus, Track 2

M2C.3 • 11:30 **Invited**
Independent Component Analysis Based Channel Equalization in Coherent Optical Fiber Transmission Systems, Xiang Li¹; ¹WRI, China. This presentation will discuss independent component analysis based channel equalization in coherent optical fiber transmission systems.

M2C.4 • 12:00 **Invited**
Recent Advances in Optical Fiber Transmission Technologies, Yi Sun¹; ¹OFS Fitel LLC, USA. We review recent progresses in optical fiber transmission technologies, focusing on high-speed SWDM-PAM4 Datacom links using advanced wideband multimode optical fibers.

Begonia, Track 3

M2D.2 • 11:30
5×5 μm² compact waveguide crossing optimized by genetic algorithm, Pengfei Xu¹, Yanfeng Zhang¹, Zengkai Shao¹, Chunchuan Yang¹, Lin Liu¹, Yujie Chen¹, Siyuan Yu^{1,2}; ¹Sun Yat-sen Univ., China; ²Univ. of Bristol, UK. A genetic algorithm optimized compact silicon waveguide crossing of 5×5 μm² for fundamental TE mode is designed, fabricated, and tested. A measured insertion loss of 0.1~0.3 dB with a crosstalk of <-35 dB is achieved.

M2D.3 • 11:45
Low-crosstalk and low-loss mode (de)multiplexer with 10 channels, Chenlei Li¹, Hao Wu¹, Daoxin Dai¹; ¹Zhejiang Univ., China. A 10-channel mode (de)multiplexer with low crosstalks and low loss over a broad wavelength band is proposed and realized with cascaded dual-core adiabatic tapers on a silicon-on-insulator (SOI) platform for the first time.

M2D.4 • 12:00
90° optical hybrid with lower loss and higher balance based on a tapered 2×4 MMI coupler and a 2×2 MMI coupler, Xiangyang Dai¹, Gongyuan Zhao¹, Qiaoyin Lu¹, Weihua Guo¹; ¹Wuhan National Laboratory, China. We propose an optimized 90° optical hybrid based on a tapered 2×4 MMI coupler and a 2×2 MMI coupler. Simulations indicate that the hybrid yields the excess loss and imbalance of 0.2dB and 0.06dB, respectively.

Orchid, Track 4

M2E.2 • 11:30 **Invited**
Experimental Demonstration of Photonics based Wideband SAR, Wangzhe Li¹; ¹Inst. of Electronics, CAS, China. A photonic-assisted synthetic aperture radar is demonstrated by employing photonic frequency doubling and stretch processing. The radar is evaluated through a series imaging tests both in a microwave anechoic chamber and in a field trial.

M2E.3 • 12:00
Low Spurs and Highly Stable Optical Comb Generation Based on an Injection-Locked Optoelectronic Oscillator, Huayang Du¹, Rui Guo¹, Huanfa Peng¹, Cheng Zhang¹, Lixin Zhu¹, Zhangyuan Chen¹; ¹Peking Univ., China. An optical comb generation based on an injection-locked optoelectronic oscillator is demonstrated. Phase noise of the photo-detected microwave signal at 10Hz offset is reduced by 30dB and the side-mode-suppression-ratio is improved by 26dB after injection-locking.

Dahlia, Track 5

M2F.2 • 11:30

Nonlinear Optical Properties of the Colloidal Quantum Dots, Jingzhou Li^{1,2}, Hongxing Dong², Long Zhang², Boru Yang¹; ¹*School of Electronics and Information Technology, State Key Lab of Opto-Electronic Materials & Technologies, Guangdong Province Key Lab of Display Material and Technology, Shunde International Joint Research Inst., Sun Yat-Sen Univ., China*; ²*Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China*. This work presents the nonlinear optical properties of colloidal quantum dots (CQDs). The CQDs dispersions show excellent saturable absorption and two-photon absorption response. Further, their use as saturable absorbers in a passively Q-switched solid-state laser is demonstrated.

M2F.3 • 11:45

Harnessing photothermal effects of plasmonic nanoparticles for optical imaging, Jian Xu¹, De-jiao Hu¹, Tianyue Zhang¹, Fei Qin¹, Xiangping Li¹; ¹*Jinan university, China*. We systematically investigate the influence of photothermal effects on the scattering property of plasmonic nanoparticles. Temperature rising and scattering-intensity map are studied both theoretically and experimentally. Applying these features, we demonstrate optical imaging based on photothermal effects of plasmonic nanoparticles.

M2F.4 • 12:00

An incoherent CW-trigger on picosecond pulse pumped supercontinuum generation, Ji Zhu¹, Qian Li¹, H.Y. Fu²; ¹*School of Electronic and Computer Engineering, Peking Univ., Shenzhen, China*; ²*Tsinghua-Berkeley Shenzhen Inst., Tsinghua Univ., Shenzhen, China*. We numerically investigate the properties of picosecond pulse pumped supercontinuum by applying an incoherent CW-trigger when CW-trigger's bandwidth varies.

Napoleon, Track 2

M2G.3 • 11:30

Experimental Demonstration of 32 Gbaud 4-PAM for Data Center Interconnections of up to 320 km, Peter Madsen¹, Lau Suhr¹, Anders Clausen¹, Idelfonso Tafur Monroy²; ¹*Technical Univ. of Denmark, Denmark*; ²*Technical Univ. of Eindhoven TUE, Netherlands*. This paper presents experimental results demonstration a 64 Gbps 4-PAM transmission over 320 km SSMF span employing standard 80 km fiber spans for metro links. The receiver consists of a LPF and a DFE utilizing the DD-LMS algorithm.

M2G.4 • 11:45

Complexity Comparison of Multi-band CAP and DMT for Practical High Speed Data Center Interconnects, Jinlong Wei¹, Christian Sanchez², Paul A. Haigh³, Elias Giacomidis⁴; ¹*Huawei Technologies Duesseldorf GmbH, Germany*; ²*Aston Inst. of Photonic Technologies (AIPIT), Aston Univ., UK*; ³*Department of Electrical and Electronic Engineering, Univ. College London, UK*; ⁴*School of Engineering & Physical Sciences, Heriot-Watt Univ., UK*. We analyze and compare the complexity of IMDD-based 56-Gb/s Multi-band CAP and DMT over 80-km DCF-free SMFs for data center interconnects. Multi-band CAP with small sub-band count has comparable complexity to DMT at similar OSNR performance.

M2G.5 • 12:00

56-Gb/s SSB-PAM4 Transmission over 100-km Dispersion-Uncompensated SSMF with Linear Pre-Equalization and Blindly Adaptive Nonlinear Post-Equalization, Zhiquan Wan¹, Jianqiang Li¹, Liang Shu¹, Songnian Fu², Yuting Fan¹, Feifei Yin¹, Yue Zhou¹, Yitang Dai¹, Kun Xu¹; ¹*State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China*; ²*School of optical and electronic information, Huazhong Univ. of Sci&Tech, China*. With the help of a linear pre-equalizer and a simplified multi-step-size blindly adaptive nonlinear post-equalizer based on the memory polynomial model, 56-Gb/s SSB-PAM4 C-band transmission over 100-km dispersion-uncompensated SSMF is experimentally demonstrated.

Louis XIII, Track 2

M2H.3 • 11:30

Optical communications over obstacles by applying two-dimensional ballistic-trajectory Airy beams, Guoxuan Zhu¹, Yuanhui Wen¹, Yujie Chen¹, Xiong Wu¹, Jie Liu¹, Yanfeng Zhang¹, Siyuan Yu^{1,2}; ¹*Sun Yat-sen Univ., China*; ²*Univ. of Bristol, UK*. We propose a scheme that can avoid obstacles by using the parabolic trajectory of two-dimensional finite-energy Airy beams in order to extend application scenarios of free space optical communications. Results confirm that the applying of Airy beams can provide a bonus of larger obstacle size than conventional Gaussian beams.

M2H.4 • 11:45 **Invited**

Coherent Reception of NFDM Signals on a Single FPGA-Board Enabled by Low Complexity Algorithms, Arne Josten¹, Benedikt Baeuerle¹, Juerg Leuthold¹; ¹*ETH Zurich, Switzerland*. Efficient DSP algorithms for coherent reception of NFDM signals are introduced and demonstrated on a single FPGA-board. With these algorithm we enable real-time reception of a 28GBd PAM and a QAM signal with 8/7 oversampling.

Marigold, Track 8

M2I.2 • 11:30 **Invited**

Semiconductor Polymer Dots for Optical Imaging and Phototherapy, Changfeng Wu¹; ¹*South Univ. of Science and Technology, China*. Semiconductor polymer dots exhibit superior brightness and tunable optical properties. This presentation describes the development of small polymer dots for biological imaging. Stimulated emission depletion (STED) imaging and Super-resolution optical fluctuation imaging (SOFI) were demonstrated.

M2I.3 • 12:00 **Invited**

Polymer Prodrug in Tumor Theranostics, Xianglong Hu¹; ¹*South China Normal Univ., China*. Stimuli-responsive nanoparticles are focused to promote the pathological specificity and controlled therapeutic activation in biomedicine, but the precise modulation of theranostic function remains challenging. Herein, polymer prodrug-based theranostic systems are developed to achieve precision diagnostic/therapeutic applications in biomedicine.

Bauhinia, Track 1

M2J.2 • 11:30

Bend-Insensitive Wideband Multimode Fiber and Cable for SWDM Systems, Rong Huang^{1,2}, Runhan Wang^{1,2}, Liyan Zhang^{1,2}, Wei Huang³, Jihong Zhu^{1,2}, Honghai Wang^{1,2}, Ruichun Wang^{1,2}; ¹*YOFC, China*; ²*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China*; ³*Shenzhen YOFC Connectivity Technologies Co., Ltd., China*. 4*25 Gbps SWDM transmission is demonstrated over the novel bend-insensitive wideband multimode fibers in the 850-950 nm wavelength range. The wideband multimode cable shows negligible macro-bending loss with 2 turns at bending radius of 7.5 mm.

M2J.3 • 11:45

Mechanical Reliability of 900 μm Buffered G.657.B3 Fibre for Residential Use, Jianbin Duan^{2,1}, Liyan Zhang^{2,1}, Jing Li^{2,1}, Changfeng Yan^{2,1}, Yong Hu^{2,1}, Tingting Tian^{2,1}; ¹*Yangtze Optical Fibre&Cable Joint Stock Limited Company, China*; ²*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China*. Mechanical reliability of 900 μm buffered G.657.B3 fibre for residential use were studied. Bend, tensile, bend combined with tensile and impact tests were performed to simulate different mechanical damage.

M2J.4 • 12:00

Tunable wavelength mode filter with mechanically induced long period fiber grating, Motoyuki Shioji¹, Hirokazu Kubota¹, Masaharu Ohashi¹, Yuji Miyoshi¹; ¹*Osaka Prefecture Univ., Japan*. We investigate a tunable fundamental-mode filter with a mechanically induced longperiod fiber grating. By changing the stress applied to the LPFG, the output excitation ratio of more than 1:20 was obtained when the input ratio was 1:1.

Magnolia, Track 1

Hydrangea, Track 2

Hibiscus, Track 2

Begonia, Track 3

Orchid, Track 4

M2B.4 • 12:15

Simple Intradynic Receiver with Time-switched Phase Diversity for Optical Interconnects, Shuangyi Yan¹, Chao Lu², Alan Pak Tao Lau², Reza Nejabati¹, Dimitra E. Simeonidou¹; ¹High performance networks group, Univ. of Bristol, UK; ²Hong Kong Polytechnic Univ., China. A time-switched phase-diversity intradyne coherent receiver is proposed based on an 180° optical hybrid, which requires only half hardware than a traditional coherent receiver. Transmission of 10 Gbaud QPSK signals over 20km SMF is demonstrated successfully.

M2E.4 • 12:15

A Simple Optical Pulse Compression Reflectometry with 7-cm Spatial Resolution based on Linearly Chirped Microwave Pulse Using a Distributed Bragg Reflector Laser, Lu Guo¹, Dan Lu¹, Ruikang Zhang¹, Guangcan Chen¹, Wu Zhao¹, Lingjuan Zhao¹, Wei Wang¹; ¹Inst of Semiconductor, CAS, China. A simple method using a distributed Bragg reflector laser to generate linearly chirped microwave pulse is proposed. With the generated pulse, the optical pulse compression reflectometry with a spatial resolution of 7-cm is experimentally realized.

12:30–14:00 Lunch Break

Dahlia, Track 5

Napoleon, Track 2

Louis XIII, Track 2

Marigold, Track 8

Bauhinia, Track 1

M2G.6 • 12:15
Probabilistic shaping for 56-Gbps PAM-4 signaling over 8-GHz-bandwidth VCSEL-modulated optical interconnection links, Lin Sun¹, Jiangbing Du¹, Guoyao Chen¹, Zuyuan He¹; ¹*Center of Intelligent Photonics, China*. In this paper, probabilistic shaping for PAM-4 signalling at 56 Gbps is demonstrated for the first time. Experiment is carried out over 8-GHz-bandwidth VCSEL-modulated optical interconnection links with significantly reduced BER due to probabilistic shaping.

M2H.5 • 12:15
An accurate stochastic distributed model for scatterings in optical fiber systems with Raman amplification, Qiguang Feng¹, Yuan Li², Qiang Zheng¹, Pu Zhang¹, You Wang¹, Wei Li¹; ¹*Wuhan National Lab for Optoelectronics, China*; ²*Dept. of Computer Science, Central China Normal Univ., China*. We proposed a stochastic model to analyze the evolution of spontaneous Raman and Rayleigh scatterings in distributed Raman amplifiers. Good agreement was obtained between the simulations and measurements, which verified the accuracy of the model.

M2J.5 • 12:15
Fabrication of phase-shifted fiber Bragg gratings with a velocity-changed scanning UV laser beam, Kuikui Guo¹, Jun He¹, Changrui Liao¹, Ying Wang¹, Yiping Wang¹; ¹*Shenzhen Univ., China*. We demonstrate a new method to fabricate phase-shifted FBGs by using a velocity-changed scanning UV laser beam together with a shielded phase mask. Changing the scanning velocity could adjust the grating phase shift.

12:30–14:00 Lunch Break

Magnolia, Track 1

14:00–15:30

M3A • Optical Fiber Sensor, Device & Technology III

Presider: Fan Li; Sun Yat-sen Univ., USA

Hydrangea, Track 2

14:00–16:00

M3B • Fiber-wireless Integration

Presider: Gangxiang Shen; Soochow Univ., China

Hibiscus, Track 2

14:00–16:00

M3C • Metro and Backbone Networks

Presider: Yongli Zhao; Beijing Univ. of Posts & Telecom, China

Orchid, Track 4

14:00–16:00

M3D • Sensing, Measurement and Other Applications

Presider: Wangzhe Li; Inst. of Electronics, CAS, China

M3A.1 • 14:00 **Invited**

Plasmonic Tilted Fiber Grating Sensors, Tuan Guo¹; ¹Jinan Univ., China. This talk review the progress of plasmonic fiber-optic sensing technology in the surface affinity studies of the biomolecules for real life problems, the electrochemical actives of biocells for clean energy resources and ultrasensitive gas detection.

M3B.1 • 14:00 **Invited**

Resource Allocation in Passive Optical Network based Mobile Backhaul for User Mobility and Fog Computing, Jiannan Ou², Jun Li¹, Lili Yi³, Jijia Chen^{1,2}; ¹Kungliga Tekniska Hogskolan, Sweden; ²South China Normal Univ., China; ³Shanghai Jiaotong University, China. Several dynamic bandwidth allocation algorithms are investigated to handle user mobility and fog computing in PON-based mobile backhaul. Results show that latency and jitter of both migrated and non-migrated traffic can be reduced.

M3C.1 • 14:00 **Invited**

Multi-Layer Restoration to Address IP Router Outages in IP-over-EONs, Siqi Liu¹, Wei Lu¹, Zuqing Zhu¹; ¹Univ of Science and Technology of China, China. We discuss how to cost-effectively address the IP router outages in IP over elastic optical networks (IP-over-EONs) with multi-layer restoration (MLR), and design an auxiliary-graph (AG) based algorithm that can minimize the additional operational expenses (OPEX).

M3D.1 • 14:00 **Invited**

OEO Based Measurement of Absolute Length with High Accuracy and Large Dynamic Range, Jinlong Yu¹; ¹Tianjin Univ., China. This presentation will discuss OEO based measurement of absolute length with high accuracy and large dynamic range.

M3A.2 • 14:30

Experimental demonstration on flattened gain over long-distance DBA-BOTDA sensors based on intensity-compensated optical-comb pump, Xin-Hong Jia¹, Kai Lin¹, Lei Ao¹; ¹Sichuan Normal Univ., China. Flattened gain was experimentally demonstrated for enhancing the performance of Brillouin optical time-domain analysis (BOTDA) sensors based on distributed Brillouin amplification (DBA) using intensity-compensated optical-comb pump.

M3B.2 • 14:30

Energy-Efficient Traffic Grooming in 5G C-RAN Enabled Flexible Bandwidth Optical Networks, Bowen Chen¹, Jie Zhang¹, Qingcheng Zhu¹, Xiaoling Wang¹, Mingyi Gao¹; ¹Soochow Univ., China. An energy-efficient grooming approach (EEGA) is proposed to save power consumption. For comparison, an existing energy-efficient approach without grooming (EEEA) is introduced. Simulation results show that EEGA reduces power consumption compared to EEEA.

M3C.2 • 14:30

Field trial of network survivability based on OTN and ROADM hybrid networking, Han Li², Haiyi Zhang¹, Lei Wang², Yunbo Li², Junsen Lai¹, Rui Tang¹, Wenyu Zhao¹, Bingbing Wu¹, Dong Wang², Xin Zhao¹, Xiaohua Tang¹; ¹CAICT, China; ²China Mobile Research Inst. (CMRI), China. We demonstrate and validate the network survivability based on hybrid OTN/ROADM field trial for the first time. The OTN relay node and adjustable transponder can further improve the robustness of survivability in hybrid OTN/ROADM network.

M3D.2 • 14:30 **Invited**

Measurement and Detection of Optical Controlled Radio Frequency Vortex Beam, Shanguo Huang¹; ¹Beijing Univ. of Posts and Telecomm, China. This presentation will discuss measurement and detection of optical controlled radio frequency vortex beam.

Dahlia, Track 5

14:00–15:30

M3E • Micro/Nanophotonics II

Presider: Shumei Chen; Univ. of Birmingham, UK

M3E.1 • 14:00 Invited

High-throughput All-optical Laser-scanning Microscopy and its Applications, Kevin K. Tsia¹; ¹Univ. of Hong Kong, China. We present all-optical laser-scanning microscopy techniques for ultrahigh-throughput single-cell imaging with multiple image contrasts (e.g. quantitative phase, fluorescence, multiphoton) at an imaging throughput of 10,000's cells/sec – paving the way toward deep, multi-scale single-cell analysis.

M3E.2 • 14:30

The plasmon optical leaky wave antenna with good performance properties, Dong-zhou Zhong¹, Chengpeng Liu¹; ¹Wuyi Univ., China. We propose two types of optical leaky-wave-antennas that have different ellipsoid-hole array structures in the metal layer. Also we explore their physical properties, such as return loss, insertion loss, radiation pattern, sidelobe level, directivity, half power beam width and bandwidth.

Napoleon, Track 2

14:00–16:00

M3F • Optical Wireless Systems

Presider: Jian Chen; Inst, for Inforcomm Research, China

M3F.1 • 14:00

A High Precision Positioning Method Based on High Speed Camera and Visible Light, Bo Bai¹, Bo Su¹, Nan Chen¹, Yangyu Fan²; ¹Xidian Univ., China; ²Northwestern Polytechnical Univ., China. A high speed camera and visible light based positioning method is proposed in this paper, which could generate the user's position, as well as the attitude information, with an extremely high precision performance. And the experimental results show a positioning precision performance in centimeters.

M3F.2 • 14:15

Design of Plastic Optical Fiber Coupling system based on GRIN Lens for Enlarging the Field-of-View of VLC System, Gendi Zhou¹, Minglun Zhang¹, Haoran Lin¹, Xinglong Lin¹, Tingting Cheng¹; ¹Beijing Univ. of Posts and Telecommunications, China. We design a plastic optical fiber coupling system based on GRIN lens to enlarge the FOV of VCL system with small photodetector, and results demonstrate that the FOV exceeds 12° with gain increased by 38dB.

M3F.3 • 14:30

Weighted Least Squares Estimator of Range Based on DMT VLC for Indoor Positioning, Zhong Zheng¹, Lu Liu¹, Weiwei Hu¹; ¹State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking Univ., China. A weighted least squares approach utilizing the training symbol of discrete multi-tone (DMT) visible light communication (VLC) is proposed to estimate the range between the LEDs and receiver, which considers the VLC channel low-pass characteristics.

Louis XIII, Track 2

14:00–15:45

M3G • Transmission Techniques II

Presider: Nan Chi; Fudan Univ., China

M3G.1 • 14:00 Invited

Optical Network Demands for 5G Mobile Access, Ronald Freund¹; ¹Fraunhofer Institut, Germany. In this talk, future optical network demands will be discussed with respect to flexibility, capacity, and programmability, especially in the context of the new 5G mobile communication standard. Latest research results of the European 5G Crosshaul project will be presented.

M3G.2 • 14:30

40-Gbit/s Honeycomb 2D-PAM4 TCM Transmission for Short Reach Applications, Yan Fu¹, Meihua Bi^{1,2}, Haiyun Xin¹, Xin Miao¹, Longsheng Li¹, Syed Baqar Hussain¹, Hao He¹, Weisheng Hu¹; ¹Dept. of Electronic Engineering, Shanghai Jiao Tong Univ., China; ²College of Communication Engineering, Hangzhou Dianzi Univ., China. We firstly demonstrate a 40-Gbit/s honeycomb 2D-PAM4 TCM transmission over 20-km fiber for short reach systems. Experimental results show that it outperforms the conventional PAM4 by ~2.8 dB (BER @ 3.8 x 10⁻³) with low extra complexity.

Bauhinia, Track 1

14:00–15:45

M3H • High Power Fiber Laser & New Amplifier Technologies II

Presider: Baishi Wang; Vytran Corporation, USA

M3H.1 • 14:00 Invited

Coherent Polarization Beam Combining of High Power Fiber Lasers: Progress and Prospect, Pu Zhou¹; ¹National Univ of Defense Technology, China. We report recent advance in coherent polarization beam combining of fiber lasers. Power scaling of all-fiberized linear-polarized fiber amplifier is studied, four channels of kilo-watt level narrow-linewidth linear-polarized fiber amplifiers are coherently polarization combined with 5.02 kW output power.

M3H.2 • 14:30

Gain-flattened Thulium Doped Fiber Amplifier Incorporating Dual-stage Pumping, Dan Zhang¹, Yizhen Wei¹; ¹Zhejiang Univ., Centre for Optical and Electromagnetic Research, State Key Laboratory of Modern Optical Instrumentation, China. A high power thulium doped fiber amplifier (TDFA) with a flat gain bandwidth over 80 nm is proposed and experimentally demonstrated. An output power over 0.67 W and an operation wavelength range from 1960 to 2040 nm have been achieved by employing a dual-stage configuration. The maximum saturated gain is 29 dB and noise figure is lower than 4 dB.

Magnolia, Track 1

M3A.3 • 14:45

Multimode Fiber Specklegram Twist Sensor, Tianting Zhong¹, Zhipeng Yu¹, Puxiang Lai¹; ¹*The Hong Kong Polytechnic Univ., China*. A twist sensor based on the analysis of multimode fiber speckle patterns is proposed. The fiber specklegrams are recorded and assessed for correlation change under different conditions. A preliminary resolution of 2.5 mrad was obtained.

M3A.4 • 15:00

Enhanced-performance BOTDA Sensing through Wavelet Transform and Gaussian Function, Feng Tian¹, Wenqing Tang², Bo Liu¹, Hongyan Zhao², Jinlong Zhang³, Yongjun Wang², Xiangjun Xin²; ¹*Nanjing Univ. of Information Science & Technology, Inst. of Optoelectronics, China*; ²*Beijing Univ. of Posts and Telecommunications, China*; ³*Henan Univ., School of Physics and Electronics, China*. This paper presents a new method of cascading wavelet transform and Gaussian function to eliminate the noise of Brillouin optical time domain analysis (BOTDA) sensing, the experiments results indicate that it could improve the performance.

M3A.5 • 15:15

Au nanoparticles-based Localized Surface Plasmon Resonance Refractometer, Shimeng Chen¹, Yun Liu¹, Qingxu Yu¹, Wei Peng¹; ¹*Dalian Univ. of Technology, China*. We demonstrated a LSPR-based refractometer with Au NPs immobilized onto inner wall of capillary. Capillary was used as both a sensing element and a flow cell, which offered wide dynamic detection range and was sensitivity-tunable.

Hydrangea, Track 2

M3B.3 • 14:45

Traffic aware Wavelength and Resource Allocation Scheme for TWDM-PON based 5G Fronthaul, Qingxin Yuan¹, Lei Wang¹, Liqian Wang¹, Xue Chen¹; ¹*Beijing Univ. of Posts and Telecomm., China*. A traffic aware wavelength and resource allocation scheme is proposed for TWDM-PON based 5G fronthaul network. Simulation results show it can meet the high capacity requirement in 5G environment and reduce occupied wavelengths and BBUs.

M3B.4 • 15:00

SDN-enabled Latency-Guaranteed Dual Connectivity in 5G RAN, Koteswararao Kondepu¹, Alessio Giorgetti¹, Francesco Giannone¹, Andrea Marotta², Filippo Cugini³, Piero Castodi¹, Luca Valcarengi¹; ¹*Scuola Superiore Sant'Anna, Italy*; ²*Universit'a degli Studi dell'Aquila, Italy*; ³*CNIT, Italy*. A novel SDN-controlled E-UTRAN interacting with 5G Radio Resource Management (RRM) featuring Dual Connectivity (DC) is proposed and experimentally demonstrated. Radio bearers are dynamically steered to different evolved NodeBs, to guarantee effective per-flow latency performance.

M3B.5 • 15:15

Demonstration of Multi-vendor Multi-standard PON Networks for Network Slicing in 5G-oriented Mobile Network, Dong Liang^{2,1}, Rentao Gu^{2,1}, Qize Guo^{2,1}, Yuefeng Ji^{2,1}; ¹*Beijing Advanced Innovation Center for Future Internet Technology, China*; ²*Beijing Laboratory of Advanced Information Network, China*. This paper proposes a unified control and network slicing architecture for multi-vendor multi-standard PON based 5G Fronthaul Network and experimentally demonstrates its flexible resource management and slicing capability.

Hibiscus, Track 2

M3C.3 • 14:45

Quantifying Spectral and Energy Efficiency Limitations of WDM Networks due to Crosstalk in Optical Nodes, Aleksejs Udalcovs¹, Richard Schatz², Paolo Monti³, Oskars Ozolins¹, Xiaodan Pang^{3,1}, Jaime Rodrigo Navarro^{1,2}, Aditya Kakkar^{2,1}, Hadrien Louchet⁴, Sergei Popov², Lena Wosinska³, Gunnar Jacobsen¹; ¹*Networking and Transmission Laboratory, RISE Acreo AB, Sweden*; ²*School of Engineering Sciences, KTH Royal Inst. of Technology, Sweden*; ³*School of Information and Communication Technology, KTH Royal Inst. of Technology, Sweden*; ⁴*Keysight Technologies Deutschland GmbH, Germany*. We demonstrate the significant impact of crosstalk between add and drop ports at optical nodes on energy-efficiency per Hertz in WDM networks employing 32/64 Gbd DP-16QAM transmission, especially when the isolation is reduced to 30dB.

M3C.4 • 15:00

Dynamic Tidal Traffic Grooming in Software Defined Metropolitan Networks, Yuqiao Wang¹, Yongli Zhao¹, Wei Wang¹, Xiaosong Yu¹, Jie Zhang¹; ¹*Beijing Univ. of Posts & Telecom, China*. Caused by user migration, geographical distribution of network traffic varies tidally in metropolitan area. We propose a dynamic lightpath provisioning strategy to groom tidal traffic during migration. Simulation shows our strategy reduce network blocking significantly.

M3C.5 • 15:15

On the Interest of WDM-Colored Optical Packets in Metro Aggregation Networks, Catherine Lepers², Djamel Amar¹, Franck Gillet², Dominique Chiaroni³; ¹*IMT Atlantique, France*; ²*Telecom SudParis, France*; ³*Nokia Bell Labs, France*. We show that N-GREEN technology is a cost-effective alternative of Ethernet technology. We also demonstrate that WDM slot sharing permits to improve latency and to differentiate Classes of Service with no impact on N-GREEN architecture.

Orchid, Track 4

M3D.3 • 15:00

Coherent Single-Mode Extraction of Agile Frequency Comb via Phase-Locking for Broadband Phase-Continuous Tuning, Weilin Xie^{1,3}, Yi Dong², Fabien Bretenaker³, Hongxiao Shi¹, Qian Zhou¹, Zongyang Xia⁴, Qin Jie¹, Xi Lin¹, Lin Zhang¹, Weisheng Hu¹; ¹*State Key Laboratory of Advanced Optical Communication Systems and Networks, Shanghai Jiao Tong Univ., China*; ²*School of Optoelectronic, Beijing Inst. of Technology, China*; ³*Laboratoire Aimé Cotton - CNRS, France*; ⁴*School of Electrical and Computer Engineering, Georgia Inst. of Technology, USA*. We report on coherent single-mode extraction from an agile frequency comb capable of agilely phase-continuous mode-spacing tuning in a broad spectral bandwidth. The highly selective extraction is achieved by phase-locking a continuous-wave laser to the high-order comb mode, allowing for efficient combining the coherence, agility, and tunability.

M3D.4 • 15:15

Chaotic Time-delay Signature Varied by Bias in a Semiconductor Laser with FBG Feedback, Song-Sui Li¹, Jia-Xin Dong¹, Sze-Chun Chan^{1,2}; ¹*Dept. of Electronic Engineering, City Univ. of Hong Kong, China*; ²*State Key Laboratory of Millimeter Waves, City Univ. of Hong Kong, China*. Chaotic time-delay signature (TDS) in a semiconductor laser with feedback from a fiber Bragg grating is investigated for the impact of the bias current. Maximum bandwidth is achieved in chaos generation with TDS concealed.

Dahlia, Track 5**M3E.3 • 14:45**

Active Control for Pump Seed Generation in OPCPA, Jie Mu¹, Kainan Zhou¹, Xiao Wang¹, Yi Guo¹, Yanlei Zuo¹, Xiaodong Wang¹, Na Xie¹, Song Zhou¹, Qihua Zhu¹, Jingqin Su¹, Xiaoming Zeng¹; ¹China Academy of Engineering Physics, China. We propose an active control method for pump seed generation in optical parametric pulse amplification (OPCPA). This proposed method has been successfully applied in a pure OPCPA system.

M3E.4 • 15:00

Asymmetric backscattering of a SiN_x microring resonator with a Mie scatterer, Zhuohui Yang¹, Zengkai Shao¹, Yanfeng Zhang¹, Bingzhi Zhang^{1,2}, Yujie Chen¹, Siyuan Yu^{1,3}; ¹Sun Yat-sen Univ., China; ²Guangzhou Univ., China; ³Univ. of Bristol, UK. We design a SiN_x microring resonator with a single Mie scatterer. Results confirm that we can obtain the asymmetric backscattering without any mode splitting by the single Mie scatterer. The extinction ratio is close to 3.55 dB at the wavelength of 1553.1 nm in the experiment.

M3E.5 • 15:15

Raman-Nath second-harmonic Talbot effect in 1D PPLT Crystal, Dongmei Liu³, Min Gu², Yong Zhang¹, Min Xiao¹, Pen Han²; ¹Nanjing Univ., China; ²South China Normal Univ., China; ³South China Normal Univ., China. We demonstrate a new method to generate second-harmonic Talbot effect through Raman-Nath diffraction in 1D PPLT crystal. Our observation not only enriches the Talbot effect, but also has potential applications for lithography and domain inspection.

Napoleon, Track 2**M3F.4 • 14:45**

Incorporate Visible Light Communication into Visible Light Positioning Using Orthogonal Frequency Division Multiple Access, Yitong Xu¹, Zixiong Wang¹, Jian Chen², Shiyang Han³, Changyuan Yu⁴, Jinlong Yu¹; ¹School of Electrical and Information Engineering, Tianjin Univ., China; ²Nanjing Univ. of Posts and Telecommunications, China; ³College of Electronic Information and Optical Engineering, Nankai Univ., China; ⁴The Hong Kong Polytechnic Univ., China. We propose a scheme to incorporate VLC into VLP using OFDMA. The VLP is implemented by measuring the average RSS on subcarrier block, and the feasibility of simultaneous VLC has been investigated.

M3F.5 • 15:00

Experimental Study of Retro-Reflective FSO Link using Micro Corner Cube Reflector Arrays Under a Controlled Laboratory Turbulence Channel, Changying Li¹, Guowei Yang¹, Meihua Bi¹, Bing Fan¹; ¹School of Communication Engineering, Hangzhou Dianzi Univ., China. This paper experimentally investigates the transmission performance of free space optical (FSO) links using a corner-cube reflector (CCR) and micro corner-cube-reflector arrays (MCCRAs) as one terminal under the laboratory atmospheric turbulence chamber.

M3F.6 • 15:15

Cost-Effective Auto-Alignment Method for Indoor Optical Wireless Communication, Seung-Rae Cho¹, Myeonggyun Kye¹, Kwangyong Lee¹, Chang-Hee Lee^{1,2}; ¹Korea Advanced Inst of Science & Tech, Korea; ²Chongqing Univ. of Technology, China. A cost-effective auto-alignment method for a wireless optical communication is proposed and demonstrated experimentally. This system is operable in 1~7 m distances with a field of view of 11 degree (angle) for both axes.

Louis XIII, Track 2**M3G.3 • 14:45**

A Joint Synchronization for FBMC-Based Spectrum Slicing Optical Transmission Systems, Tu Nguyen¹, Son T. Le², Marc Wuilpart¹, Patrice Megret¹; ¹Univ. of Mons, Belgium; ²Nokia Bell Labs, Germany. We propose an effective joint synchronization scheme for FBMC-based spectrum slicing long-haul transmissions, showing a negligible penalty (<0.2 dB) at a large timing mismatch of 500 ps in a three-spectral slice 76.8 Gbaud DP-16QAM system.

M3G.4 • 15:00

Demonstration of Cost-Effective Single-Photodetector Coherent Receiver for Free-Space Optical Communications, Zhihang Wu¹, Hexin Jiang¹, Xianglian Feng¹, Shiming Gao¹; ¹Zhejiang Univ., China. A cost-effective coherent receiver using a single photodetector and analog-to-digital converter based on Kramers-Kronig relation is experimentally demonstrated. A sensitivity of 11 dB photons per bit is achieved at the bit error rate of 0.01.

M3G.5 • 15:15

Self-Injection Locked L-band Quantum-dash Laser Diode as a Source for Indoor Optical Wireless Communication, Mohamed Shemis², Emad Alkhazraji², Muhammad T. Khan², Maged Esmail¹, Amr Ragheb¹, Habib Fathallah^{3,4}, Saleh Alshebeili^{1,3}, Mohammed Zahed M. Khan²; ¹KACST-TIC in Radio Frequency and Photonics for the e-Society, Saudi Arabia; ²Optoelectronics Research Laboratory, Electrical Engineering Dept., King Fahd Univ. of Petroleum and Minerals, Saudi Arabia; ³Electrical Engineering Dept., King Saud Univ., Saudi Arabia; ⁴Computer Dept. of the College of Science of Bizerte, Univ. of Carthage, Tunisia. We demonstrate 128 and 176 Gb/s class DP-QPSK optical wireless communication system over 5 m indoor channel based on a novel tunable self-seeded InAs/InP quantum-dash laser diode at ~1607 nm.

Bauhinia, Track 1**M3H.3 • 14:45**

Tunable 3 μ m Pulsed Fiber Gas Laser Source, Zhiyue Zhou¹, Ni Tang¹, Zefeng Wang¹, Weihong Hua¹; ¹National Univ of Defense Technology, China. We demonstrate a 3.1-3.2 μ m tunable pulsed fiber gas laser source using an acetylene-filled hollow-core fiber pumped with a tunable, narrowband and modulated diode-seeded fiber amplifier. The maximum output power is 76 mW, and the power conversion efficiency is ~11%.

M3H.4 • 15:00

High repetition-rate 2 μ m ultrafast source for data communication and processing, Jiarong Qin¹, Yafei Meng¹, Wenbin Gao¹, Yao Li¹, Jinlong Xu¹, Shining Zhu¹, Frank (Fengqiu) Wang¹; ¹Nanjing Univ., China. Spectrally masked phase modulation technique is used to demonstrate a 2 μ m picosecond source, with continuously tunable repetition rate up to 6 GHz. Such a source is useful for 2 μ m data communication and processing.

M3H.5 • 15:15

High power 1.9 μ m fiber hydrogen Raman Amplifier, Zhixian Li¹, Yulong Cui¹, Zefeng Wang¹; ¹National Univ of Defense Technology, China. We report here a high-power 1.9 μ m gas Raman amplifier using a hydrogen-filled hollow-core fiber. The maximum average power is 570 mW, to the best of our knowledge, which is the highest average power for such similar experiments. The maximum quantum efficiency is about 55.6%, and the corresponding slope efficiency is about 31.3%.

Magnolia, Track 1**Hydrangea, Track 2****Hibiscus, Track 2****Orchid, Track 4****M3B.6 • 15:30**

Hierarchical Edge Cloud-based Traffic Offloading Enabling Low-Latency in 5G Optical and Radio Network, Chuang Song¹, Min Zhang¹, Yueying Zhan²; ¹State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecom., China; ²Technology and Engineering Center for Space Utilization, Chinese Academy of Science (CAS), China. A hierarchical edge cloud-based traffic offloading scheme combining with SDN control for achieving low latency are presented in 5G optical and radio network. The performance evaluation demonstrates the feasibility and effectiveness of the proposed scheme.

M3B.7 • 15:45

Wireless Service Aware Latency Optimization in a Time Division Multiplexing Passive Optical Network based Mobile Fronthaul, Wei Yuan¹, Jiawei Zhang¹, Xingang Huang², Yuefeng Ji¹; ¹State Key Laboratory of Information Photonics and Optical Communications, Univ. of Posts and Telecommunications, China; ²ZTE Corporation, China. We propose a latency optimization method which allows efficient mapping between wireless service QCI and ONU priorities over a TDM-PON based MFH. Low average latency can be achieved for high priority wireless services.

M3C.6 • 15:30

Distance-Aware Requester Grouping for Distributed Sub-Tree Scheme in Elastic Optical Datacenter Networks, Xin Li¹, Ying Tang¹, Tao Gao¹, Lu Zhang¹, Shan Yin¹, Bingli Guo¹, Shanguo Huang¹; ¹State Key Laboratory of Information Photonics and Optical Communication, Beijing Univ. of Posts and Telecommunications, China. A distance-aware requester grouping (DA-RG) strategy which aims to minimize the total spectrum consumption of all constructed sub-trees is proposed for the distributed sub-tree scheme. Simulations show that DA-RG achieves spectrum-efficient multicast service provisioning.

M3C.7 • 15:45

Topology Design upon Software Defined Optical Networks, Liyun Shi¹, Yaolin Chai¹, Yihong Hu¹, Guochu Shou¹, Yaqiong Liu¹, Zhigang Guo¹; ¹School of Information and Communication Engineering, Beijing Key Laboratory of Network System Architecture and Convergence, China. A topology design system including its working process upon SDON is proposed. It constructs network topology and evaluates quantitatively for simulated backbone network. It can implement topology designing dynamically and automatically.

M3D.5 • 15:30

Experimental demonstration of fully photonics based random number generation, Pu Li¹, Luxiao Sang¹, Ya Guo¹, Yuncai Wang¹; ¹Taiyuan Univ. of Technology, China. Combining laser chaos with photonic signal processing, we present a fully photonic method for physical random number generation, which can efficiently overcome the electronic bottleneck and has the potential to reach a 100 Gb/s real-time rate.

M3D.6 • 15:45

A Figurative Identification for Superposed OAM Modes in FSO Systems, Haowei Shi¹, Mutong Xie¹, Xinlu Gao¹, Shanguo Huang¹; ¹Beijing Univ. of Posts and Telecom, China. We demonstrate that a complete projection in Hilbert Space figuratively describes a superposed state, introducing a new scale to qualify an FSO system. Measurement simulation of superposed OAM beam through this projection scheme is given.

15:30–16:00 Coffee Break and Exhibition, Corridor 3F Corridor 3F and Exhibition Area

Dahlia, Track 5

Napoleon, Track 2

Louis XIII, Track 2

Bauhinia, Track 1

M3F.7 • 15:30

Performance Analysis of Free Space Optical Communication under Atmospheric Polarization Effect, Jiankun Zhang¹, Anhong Dang¹; ¹*Peking Univ., China*. We theoretically and numerically analyze the performance of polarization modulation free space optical communication in the presence of polarization fluctuations of atmosphere. The polarization rotation, polarization-dependent power loss and phase shift effects are all considered.

M3F.8 • 15:45

Experimental Performance of 2x2 Alamouti Space-Time Coding Non-line-of-sight Ultraviolet Communication System, Risheng Cong¹, Yong Zuo¹, Feiyu Li¹, Lingchao Meng¹, Heng Qin¹, Jinnan Zhang¹, Jian Wu¹; ¹*Beijing Univ. of Posts & Telecom., China*. Alamouti space-time block coding is applied to a 2x2 non-line-of-sight ultraviolet communication system. Experimental results show the Alamouti coding scheme outperforms other diversity schemes and has better anti-fading performance and reliability.

M3G.6 • 15:30

Machine-learning-based Coherent Optical Communication System, Wei Chen¹, Junfeng Zhang¹, Mingyi Gao¹, Yang Ye¹, Xiaoyi Chen¹, Bowen Chen¹; ¹*Soochow Univ., China*. We experimentally demonstrate a 75-Gb/s 64-QAM coherent optical communication system using support-vector machine (SVM) decision boundary algorithm to create the optimal symbol decision boundary for improving the system performance.

M3H.6 • 15:30

Passively harmonic mode-locking in an Erbium-doped fiber laser based on carbon nanotubes film at repetition rates to 500MHz, Chengbo Mou¹, Qianqian Huang¹, Chuanhang Zou¹, Tianxing Wang¹, Mohammed AlAraini^{2,3}, Aleksey Rozhin^{2,3}; ¹*Shanghai Univ., China*; ²*Aston Inst. of Photonic Technologies, Aston Univ., UK*; ³*Nanoscience Research Group, Aston Univ., UK*. Passively harmonic mode-locking (HML) of an Erbium-doped fiber laser using carbon nanotubes polyvinyl alcohol (CNTs-PVA) film is presented. The 20th harmonic mode-locking pulses at 500MHz repetition rate with 42dB super-mode suppression ratio (SMSR) are achieved.

15:30–16:00 Coffee Break and Exhibition, Corridor 3F Corridor 3F and Exhibition Area

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