Poster Session

Track 1: Optical Fibers and Fiber-based Devices

ACPPOEM-0531-1
Hollow-core Fiber with Eight U-shaped Tubes
Yu Pan, Yu cheng, Houquan Liu, Xiao Yiming, libo yuan
Guilin University of Electronic Technology, China
In this paper, we propose a hollow-core fiber with eight U-shaped tubes and discuss a method for reducing loss in hollow-core fibers. A three-order of magnitude reduction in confinement loss can be achieved using this method, which improves hollow-core fiber beam capacity significantly. Furthermore, the eight U-shaped tubes in our proposed hollow-core fiber provide greater flexibility in the design, making it suitable for a variety of applications, such as electronic communication, biosensing and lasers.

ACPPOEM-0707-3
Prediction of Optical Fiber Cable Lifespan Based on Bi-LSTM and Attention Mechanism
Weihua Lian[1], Yuan Li[2], Mengchao Niu[2], Jiaye Zhu[2], Wei Li[1]
1.Huazhong University of Science and Technology, China; 2.Central China Normal University, China
In this paper, multiple factors, including weather conditions such as lightning, wind vibration, as well as the length, stress, and loading ratio of optical cables under all-weather conditions, are comprehensively evaluated in the prediction model. This model can provide more reliable guarantees for ensuring the development and application of optical cable technology, benefiting the industry and its related applications through more effective management and maintenance methods. Simulation results on the experimental dataset presented in this paper demonstrated that the proposed model outperformed other models in predicting the lifespan of optical cables.

ACPPOEM-0719-3
Crosstalk Estimation in Multicore Fiber with Random Bending, Twisting and Structure Fluctuations Perturbations
Hou Shiwen, Xiang Lian
Suzhou Key Laboratory of Advanced Optical Communication Network Technology, China
A novel model for inter-core crosstalk (ICXT) estimation in weakly coupled multi-core fiber based on coupled power theory has been derived with various random perturbations. The simulation shows that in addition to bending and structure fluctuations, twisting has a significant impact on ICXT.

ACPPOEM-0728-24
PLSR Enhanced Ultra-wide Measuring Range Fiber-optic Curvature Sensor Based on Mode Switching Effect in Four Mode Fiber
Xu Wei[1,2], Tang Mutian[3,4], Zhen Li[5], Chen Enqing[6], Tao Jin[5,7], Yu Changyuan[8], Sheng Chunmin[9], Xu Feng[10]
1.School of Electronic and Information Engineering Changshu Institute of Technology, China; 2.Zhejiang Dongtong Optical Network IoT Technology Co., Ltd,, China; 3.Suzhou Source-Digit Communication Technology Co., Ltd,, China; 4.School of Economics and Management Tsinghua University, China; 5.National Key Laboratory of optical communication technology and network China information and Communication Technology Group Co., Ltd., China; 6.Xi'an High Technology Institute, China; 7.Peng Cheng Laboratory, China; 8.Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong, China; 9.Zhejiang Dongtong Optical Network IoT Technology Co., Ltd,, China; 10.SEU-FEI Nano-Pico Center, Key Laboratory of MEMS of Ministry of Education Southeast University, China
A partial least squares regression (PLSR) enhanced ultra-wide measuring range fiber-optic curvature sensor based on mode switching effect in four-mode fiber is proposed and investigated. The curvature measuring range covers from 0 to 8 m^{-1}.

ACPPOEM-0729-5
Temporal-spectral transient dynamics of pulsating solitonsin an ultrafast fiber laser
Junwen Li, Heping Li, Zhuang Wang, Zhiyao Zhang, Yong Liu
University of Electronic Science and Technology of China, China
We demonstrate a time-lens-based temporal magnifier. By utilizing the temporal magnifier and dispersive Fourier transform technique, the temporal-spectral transient dynamics of pulsating solitons are simultaneously measured in an ultrafast fiber laser.

ACPPOEM-0730-38
Longitudinal Mode Broadening in Multi-wavelength Raman Fiber Laser
Yanxin Li, Jiancheng Deng, Ming Shen, Zuowei Xu, Xuewen Shu
Huazhong University of Science and Technology, China
We demonstrate longitudinal mode broadening behavior in multi-wavelength Raman fiber lasers utilizing Sagnac filters. With the increase of pump power, the discrete longitudinal modes gradually broaden and adjacent longitudinal modes overlap.

ACPPOEM-0731-25
All-Fiber LP Mode Converter Based on Cascaded Long-Period Fiber Gratings in the Elliptical Ring Core Fiber
Ziwen Bai, Hu Zhang, Jiaqi Wang, Xiaoguang Zhang, Lixia Xi
Beijing University of Posts and Telecommunications, China
A linearly polarized mode converter based on cascaded long-period fiber gratings in the elliptical ring core fiber is proposed, which exhibits the maximum 10 and 15 dB bandwidths are 188.7 and 165.5 nm, respectively.

ACPPOEM-0731-51
Weakly-Guiding and Weakly-Coupling Ring-Core Fiber with 8 Fully Lifted Mode Groups for Orbital Angular Momentum Mode Space-Division Multiplexing
Xi Zhang[1,2], Jun Liu[1,2], Jian Wang[1,2]
1.Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
We propose a ring-core fiber supporting 8 fully lifted OAM mode groups including 3 radially higher-order mode groups with minimum effective index difference between adjacent mode groups larger than 1.21×10^{-3} at 1550 nm.

ACPPOEM-0731-56
High-Flat-Gain and C+L Band Distributed Raman Amplifier Applied in 3 Mode-Group-Division Multiplexing and WDM Long-Haul MIMO-Free Transmission over 104-km Ring-Core Fiber
Yuchen Zhang[1,2], Xi Zhang[1,2], Guofeng Yan[1,2], Min Yang[1,2], Mutian Xu[1,2], Jun Liu[1,2], Jian Wang[1,2]
1.Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
We demonstrate 3 orbital angular momentum mode-group-division multiplexing assisted with wavelength-division multiplexing for MIMO-free transmission over 104-km ring-core fiber. The distributed Raman amplifier in system shows high flat gain (10dB) over the C+L band.

ACPPOEM-0731-72
Low Differential Modal Gain Trench-assisted Ring-core Erbium-doped Fiber Amplifier Supporting 14 Orbital Angular Momentum Modes
Jiaqi Wang[1], Hu Zhang[1], Haixia Feng[1], Cheng Du[2], Wei Li[2], Jing Yang[1], He Wen[1], Xiaoguang Zhang[1], Lixia Xi[1]
1.State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China; 2.Fiberhome Telecommunication Technologies Co. Ltd., China
A ring-core erbium-doped fiber amplifier for mode division multiplexing is proposed to amplify 14 orbital angular momentum modes with gains more than 23dB and differential modal gain less than 1dB.

ACPPOEM-0731-88
Wide measurement range vector curvature sensor based on single stress applying fiber
Jiaqi Cao, Shuqin Lou, Xin Wang
Beijing Jiaotong university, China
To solve the limited measurement range of existing optical fiber curvature sensors, a vector curvature sensor, constructed using the single stress applying fiber (SSAF)-based Sagnac interferometer is presented and experimentally validated. The experiment results demonstrate that the sensor enables curvature measurement over a wide measuring range from $11m^{-1}$ to $26.8m^{-1}$ with the sensitivity of -2.6nm/m^{-1} in upward direction and 1.6nm/m^{-1} in downward direction. Compared with existing sensors, the measurement range has been greatly improved.

ACPPOEM-0731-119
A gas pressure sensor based on optical fiber Fabry-Perot interference
Yuexin Li, Weiming Lyu, Yujian Li, Qing Wang, Xiuyuan Wang, Weihao Yuan, Changyuan Yu
The Hong Kong Polytechnic University, Hong Kong, China
An FPI-basedgas pressure sensor made of single-mode fiber-hollow-core fiber-twin-core fiber is proposed and experimentally observed. The gas pressure sensitivity is ~4.4 nm/MPa and the temperature cross-sensitivity is low to ~0.325 kPa/℃ .

ACPPOEM-0801-20
Sensitivity enhanced optics fiber acoustic sensor for gas leakage detection in booster station
Gang Li[1], Xiaohui Lin[1], Kehong Zeng[1], Bin Zhou[2], Wenming Yang[1], Fei Wang[1]
1.China Petroleum Pipeline Telecom & Electricity Engineering Co.,Ltd, China; 2.South China Normal University, China
An optics fiber acoustic sensor with sensitivity enhanced tube was proposed. The acoustic sensor was used for gas leakage detection in the booster stations of the China West-East Gas Pipeline Project. Many environment noises like hay mower, cicada chirp could seriously interfere the leakage detection. By optimizing the features in the frequency domain, the identification rate was promoted up to 99. 6%.

ACPPOEM-0801-29
Low-loss Fan-in/Fan-out Devices Based On Multi-Cladding Bridge Fibers
Yi Huang, Hai Yang, Chuanlu Deng, Yingying He, Xiaobei Zhang, Tingyun Wang
Key laboratory of Specialty Fiber Optics and Optical Access Networks, Shanghai University, China
We utilized bridge fibers and fused taper method to achieve 7-core fiber fan-in/fan-out devices with low crosstalk of below -51.0 dB. The insertion losses for the devices are 0.56 dB and 0.58 dB, respectively.

ACPPOEM-0801-47
A Giant Fiber-optic Gyroscope with Ultra-low Bias Instability
Yanjun Chen, Huimin Huang, Wenbo Wang, Lanxin Zhu, Xinyu Cao, Xiangdong Ma, Zhengbin Li
Peking University, China
A giant fiber-optic gyroscope is implemented. Temperature compensation based on multiple temperature sensors is used to suppress the effects of the time-varying temperature field. A static observation shows that the bias instability reaches 1.7×10^{-6} °/h.

ACPPOEM-0801-66
All-polarization-maintaining L-band fiber ring laser mode-locked by nonlinear polarization rotation
Guanyu Ye[1], Kin Kee Chow[2], Maolin Dai[1], Takuma Shirahata[1], Shinji Yamashita[1], Sze Yun Set[1]
1.The University of Tokyo, Japan; 2.Manchester Metropolitan University, United Kingdom
We report the first all-polarization maintaining (all-PM) nonlinear polarization rotation (NPR) mode-locked fiber ring laser in the all-anomalous dispersion regime. The laser generates pulses at 1575 nm with a 5 nm spectral width.

ACPPOEM-0801-69
HighConversion EfficiencyLinearly Polarized Single-frequency Fiber Laser Based on Yb: YAG Crystal-derived Silica Fiber
Yongtao Chen, Jianxiang Wen
Shanghai University, China
We demonstrated a linearly polarized single-frequency fiber laser (SFFL) using a 0.7-cm-long Yb:YAG crystal-derived silica fiber (YCDSF). Its optical-to-optical efficiency is 73.8% and polarization extinction ratio (PER) is 31.3 dB.

ACPPOEM-0801-83
Helical-structure phase-shifted Bragg grating fabricated by femtosecond laser
Wang Hupo, Lin Jing, Wu Zhifang
Huaqiao University, China
We demonstrate the fabrication of a novel helical-structure phase-shifted fiber Bragg grating(PS-FBG) by using a femtosecond laser direct writing technique in the single-mode fiber. This approach provides a single-step method for creating PS-FBG. The unique helical structure could introduce phase in the fiber Bragg grating. And a PS-FBG with a narrow 3-dB bandwidth of 35 pm and a peak wavelength of 1552.7 nm was achieved. In addition, the proposed helical-structure PS-FBG exhibited a low strain sensitivity(9.175 pm/με).

ACPPOEM-0801-99
Frequency domain separation of DAS multi-source aliased signals
Huaxin Gu[1], Shuaiqi Liu[1], Feihong Yu[1], Deyu Xu[1], Xingwei Chen[1], Liyang Shao[1], Yu Wu[2], Haifeng Zhang[3]
1.Southern University of Science and Technology, China; 2.University of Electronic Science and Technology, China; 3.Research Institute of Tsinghua University, Pearl River Delta, China
In this paper, fast independent vector analysis (FastIVA) based on convolutionalaliasing model is proposed to separate the aliased signals collected by distributed acoustic sensing (DAS) system, and the time-frequency entropy is used to judge the separation performance. The results show that the time-frequency entropy interval of the separated signals and the source signals correspond to each other, which means that the aliased signals are separated. This method is used to improve the accuracy of DAS system signal detection and recognition in complex real environment, and reduce the number of false alarm events.

ACPPOEM-0801-120
Design and application of pressure sensor based on double plate waveguide core microstructure fiber
Liuyi Xu
Huaqiao University, China
Devices made of flat waveguides are easy to be highly integrated, and flat-core optical fibers reduce the losses incurred in packaging compared to conventional flat waveguides. The coupling effect between the optical waveguides creates resonance peaks at different wavelengths. The design of a bent dual flat plate waveguide core fiber is proposed, and the entry of the bending modulation brings a special loss window as well as special mode transitions with reduced transmission loss. The bending position is in the middle of the three equal parts of the flat plate part, taking the flat plate spacing of 600 nm, the flat plate thickness of 350 nm, and the radius of curvature of 25,000 nm, and the full vector finite element method is used, and we detect the samples under different pressures, which will be gradually increased from 0.2 to 1 MPa every 0.2 MPa, and the sensitivity of the pressures is 14.000 nm/MPa , and the R-Square is 99.9%, with the plate spacing between 550nm-650nm changes, the sensitivity is basically unchanged, the plate spacing has less impact, the radius of curvature between 25000-35000 changes, the sensitivity changes are larger radius of curvature has a greater impact. The designed sensor selects different radius of curvature parameters to get the required corresponding characteristic wavelength and sensitivity. The sensitivity is higher compared to other barometric pressure sensors and hence has a great potential in the application of detecting barometric pressure.

ACPPOEM-0801-140
High Repetition Rate Harmonic Mode-locked Erbium-doped Fiber Laser Based on Graphene Saturable Absorber
Jianwei Zhou[1], Feng Tian[1], Xiaodong Liu[2], Yutian Li[1], Tianze Wu[1], Qi Zhang[1], Qinghua Tian[1], Fu Wang[1]
1.Beijing University of Posts and Telecommunications, China; 2.Beijing Ancoren Science& Technology Co.,ltd, China
A passively harmonic mode-locked Er-doped fiber laser based on graphene saturable absorber(GSA) is demonstrated. The repetition rate of 6.253GHz corresponding to 348th harmonic is obtained for the first time among the same structure of lasers.

ACPPOEM-0808-1
Optimal Few-mode Self-similar Pulse Compression In Photonic Crystal Fibers
Liu Baojun[1], Yuan Jinhui[1], Mei Chao[2]
1.Beijing University of Posts and Telecommunications, China; 2.University of Science and Technology Beijing, China
Few-mode self-similar pulse compression in tapered photonic crystal fibers (TPCF) is proposed. Simulation results show that for 1.55-ps input pulse, self-similar pulse compression with 10 factor can be realized for three modes in 1.9-m.

ACPPOEM-0809-4
100 GHz high-repetition-rate vortex fiber laser
Zhi-Yin Feng, Wen-Yao He, Hu Cui, Zhi-Chao Luo, Wen-Cheng Xu, Ai-Ping Luo
South China Normal University, China
We propose a 100 GHz high-repetition-rate vortex pulse fiber laser based on the dissipative four-wave-mixingmode-locked technique, for the first time to the best of our knowledge,delivering ±1 order vortex pulses.

ACPPOEM-0814-57
Mode Dependent Loss EqualizedFew-mode Fiber Photonic Lantern
Yingxuan Li, Senyu Zhang, Jing Liu, Zhuyixiao Liu, Zhiyong Zhao, Ming Tang
Huazhong University of Science and Technology, China
We propose and fabricate anabnormal photonic lantern, which can equalize mode dependent loss for two LP mode transmission, therefore it can not only accomplish mode multiplexing and demultiplexing, but also mode equalization.

ACPPOEM-0815-14
Low Latency Fiber CommunicationSystem Equalizer Based onPhotonicReservoir Computing
Xiaoyan Zuo[1], Li Pei[1], Bing Bai[1,2], Bowen Bai[3], Jianshuai Wang[1], Juan Sui[2]
1.Beijing Jiaotong University, China; 2.Photoncounts (Beijing) Technology Co. Ltd, China; 3.Peking University, China
We demonstrate a low latency fiber channel distortion equalizer basing on photonic reservoir computing chip for C-band IMDD link.The equalizer can adapt to different optical fiber transmission distances and signal rates without modifying photonic chipstructure.

ACPPOEM-0815-28
O-Band Optical Burst Mode Amplifier for Optical Switching Data Center Networks
Kit On CHUNG[1,2], Kwong Shing Tsang[1], Wai Sing Man[2], Dongmei Huang[1], Pak Tao Lau[1], Chao Lu[1]
1.The Hong Kong Polytechnic University, Hong Kong, China; 2.Amonics Limited, China
An O-band optical burst mode amplifier is demonstrated for optical switched data center interconnects. Linear gain and gain variation among different input peak levels of less than 1.3dB have been realized.

ACPPOEM-0815-35
Photonic Crystal Fiber Refractive Index Sensor Based on Surface Plasmon Resonance Effect
Danlin Feng, Jinhui Yuan, Jingao Zhang, Kuiru Wang, Binbin Yan, Xinzhu Sang
Beijing University of Posts and Telecommunications, China
A photonic crystal fiber (PCF) refractive index (RI) sensor based on surface plasmon resonance effect is proposed. The maximum sensitivity of the PCF RI sensor can reach 28,300 nm/RIU in the RI range of 1.30 to 1.40.

ACPPOEM-0815-42
Research on the Splicing performance of G.654.E optical Fiber
Hongyan Zhou[1], Guangzhe Wu[2], Jun Wu[1]
1.Key Laboratory of Optical Fibre and Cable Manufacture Technology, Yangtze Optical Fibre and Cable Joint Stock Limited Company, Optics Valley Laboratory, China; 2.State Grid Information & Telecommunication Branch, China
Novel G.654.E has been large-scale deployed in optical communication network, so it has become urgent problems to reduce the splicing loss, improve the success probability of in one splicing and unsatisfactory splicing loss from different manufacturers in practical engineering applications. Based on the theory of single-mode fiber splicing loss testing, we obtained a large number of laboratory experiment data and practical network engineering data to verify the splicing performance form the same and different manufacturers of G.654.E fiber in various aspects based on different splicing machines. And also we propose a targeted splicing optimization scheme for practical engineering applications. All of the research provides a guidance for engineering application of G.654.E optical fiber in practical network engineering.

ACPPOEM-0815-57
Simultaneous measurement of magnetic field and temperature by using 3D printed multicore fiber-tip probes
Cong Xiong, Caoyuan Wang, Wei Ji, Limin Xiao
Fudan University, China
An ultracompact multicore fiber-tip sensor is proposed, designed, and experimentally demonstrated. The 3D printed multicore fiber-tip probes provide a highly sensitive and reliable scheme for discriminative measurement of magnetic field and temperature.

ACPPOEM-0815-76
Broadband Helical Long-Period Grating Inscribed in a Double-Cladding Fiber
Chen Jiang[1], Ying Wan[2], Zuxing Zhang[1], Yuehui Ma[3], Chengbo Mou[3], Yunqi Liu[3]
1.Nanjing University of Posts and Telecommunications, China; 2.Nanjing University of Information Science & Technology, China; 3.Shanghai University, China
We demonstrate the fabrication of a broadband helical long-period grating using a CO_2-laser automated inscription technique. A 10-dB bandwidth of 160 nm was achieved for the grating, which featured a compact length of 5.98 mm.

ACPPOEM-0815-85
All-fiber mode-locked femtosecond laser based on Er: YAG crystal-derived silica fiber
Ying Wan[1], Chen Jiang[2], Yuxia Zheng[3], Yongtao Chen[3], Taximaiti Yusufu[4], Jianxiang Wen[3]
1.Nanjing University of Information Science & Technology, China; 2.Nanjing University of Posts and Telecommunications, China; 3.Shanghai University, China; 4.Xinjiang Normal University, China
We demonstrated an all-fiber mode-locked femtosecond laser employing a 7.6 cm long Er: YAG crystal-derived silica fiber.

The mode-locked pulses operate with a duration of 686 fs and achieve a signal-to-noise ratio of 83.6 dB.

ACPPOEM-0815-92
Study on the optical radiation distribution of Gaussian and vortex beams based on AFM
Hengfei Guo[1], Yana Shang[1], Zhenmin Liu[1], Shaoying Li[1], Yong Liu[1], Na Chen[1], Shupeng Liu[1], Heming Wei[1], Fufei Pang[1]
Shanghai University, China
Information regarding the optical radiation distribution of Gaussian and vortex beams is characterized, by recording the optical force applied to the apex of atomic force microscopy (AFM) probe.

Track 2: Optical Transmission Systems, Subsystems and Technologies

ACPPOEM-0505-1
Influence of analogue-to-digital converters on multichannel digital nonlinearity compensation in 200-Gb/s-per-wavelength DP-QAM transmission systems
Zhang Yunfan[1], Xu Tianhua[1,2,3], Wang Yulin[2], Jin Cenqin[2], Xu Tongyang[3,4], Tan Mingming[5], Zhao Jian[1], Liu Tiegen[1]
1.School of Precision Instruments and Opto-Electronics Engineering, Tianjin University, China; 2.School of Engineering, University of Warwick, United Kingdom; 3.Department of Electronic and Electrical Engineering, University College London, United Kingdom; 4.School of Engineering, Newcastle University, United Kingdom; 5.Aston Institute of Photonic Technologies, Aston University, United Kingdom
In this paper, the comprehensive research on the influence of analog-to-digital converters (ADCs) resolution bits on the performance of the multichannel DBP (MC-DBP) has been carried out in high-capacity optical fiber communication systems.

ACPPOEM-0629-1
Mode crosstalk mitigation based on convolutional neural network in direct detection mode division multiplexing passive optical network
Li Chen, Hui Yang, Lianshan Yan, Xiaoyu Lu
Southwest Jiaotong University, China
A crosstalk mitigation scheme based on convolutional neural networks is proposed for MDM-PON. The simulation results show the proposed scheme can effectively compensate for channel impairment without requiring information from other modes.

ACPPOEM-0712-1
Investigations of wavefront shaping for improving the transmission distance of VCSEL-MMF based optical communication links
Daohui Hu[1], Lin Sun[1], Bin Chen[2], Ning Liu[1], Gangxiang Shen[1]
1.Soochow University, China; 2.Hefei University of Technology, China
We investigate the wavefront shaping technique to improve the transmission distance of VCSEL-MMF optical links. Impacts of the number of sub-blocks and phase accuracy of wavefront shaping on the improving performance is analyzed by simulations.

ACPPOEM-0713-2
Experimental Demonstrations of Point-to-multipoint Flexible Optical Transceiver-enabled Concurrent Direct Inter-ONU and Upstream Communications in IMDD PONs
Wei Jin[1], Lin CHEN[2], Jiaxiang He[1], Roger Philip Giddings[1], Hao Ming[3], Jianming Tang[1]
1.Bangor University, United Kingdom; 2.Shanghai University of Electric Power, China; 3.Sichuan University of Science and Engineering, China
Point-to-multipoint flexible optical transceiver-enabled concurrent direct inter-ONU and upstream communications are experimentally demonstrated in 62.47Gbit/s@27km IMDD PONs. The PONs flexibly and adaptively establish simultaneous ONU-to-ONU and ONU-to-OLT communication connections according to end-user's dynamic requirements.

ACPPOEM-0719-2
Linear Fitting-Based Residual Frequency Offset Compensation in Simultaneous Transmitting and Sensing System Using Coherent Transponders
Hao Zhou[1], Wen Zuo[1], Yaojun Qiao[1], Yan Zhao[2], Bing Ye[2]
1.Beijing University of Posts and Telecommunications, China; 2.ZTE Corporation, China
A linear fitting-based residual frequency offset compensation (LF-RFOC) algorithm is proposed for simultaneous transmitting and sensing using transponders. The power spectrum density of phase noise induced by residual frequency offset is mitigated by 34.5 dB.

ACPPOEM-0719-4
Integrated Radar Jamming and Secure Wireless Communication Based-on Photonics at Ka-band
Wang Yanyi[1], DuDongju[1], Songying Xiong[1], Lizheng Xuan[1], Ye Nan[1], Zhangqian Wu[1], Zhang Junjie[1], Chen Jian[1], Cao Bingyao[1], Yu Jianjun[2]
1.Shanghai University, China; 2.Fudan University, China
We propose and experimentally demonstrate a novel scheme that integrates radar jamming signal generation and chaotic encryption wireless communication based on photonics.

ACPPOEM-0719-6
Decision Feedback Channel Estimation for Integrated Mobile VLCP Based on STBC-MIMO
Yuzhe Sun[1], Xiaodi You[1], Jian Chen[2], Changyuan Yu[3], Mingyi Gao[1], Gangxiang Shen[1]
1.Soochow University, China; 2.Nanjing University of Posts and Telecommunications, China; 3.The Hong Kong Polytechnic University, Hong Kong, China
Decision feedback channel estimation is employed to enhance the performance of an integrated mobile VLCP system based on STBC-MIMO, where reliable communication and positioning can simultaneously be achieved when receiver moves at 1 m/s.

ACPPOEM-0721-2
Convolutional Neural Network based Equalization for 112-Gbit/s High Speed Optical Link
Na Li[1], Wei Li[1], qanggao Hu[2], Yi Jiang[2], liyan Huang[2], Peili He[1], Zhongshuai Feng[1]
1.Huazhong University of Science and Technology, China; 2.Accelink Technologies Co., Ltd, China
We proposed a CNN-based equalizer with 2 convolutional layers, 2 full-connected layers and 1 output layers. We experimentally demonstrate 112-Gbit/s PAM transmission based on a 30-GHz MZM over 2/10-km SSMF at 1550nm using the equalizer.

ACPPOEM-0724-3
Optimization of NB-QC-LDPC codes with column weight not exceeding three
Jingke Zou, liqian Wang
Beijing University of Posts and Telecommunications, China
The non-binary quasi cyclic low-density parity-check (NB-QC-LDPC) code is a strong candidate code in optical communication. However, the presence of elementary absorbing sets in NB-QC-LDPC codes can degrade the frame error rate (FER) performance of the codes in the error floor region. Additionally, better minimum Hamming distance distribution can improve the FER performance of codes in the waterfall region. In this paper, a joint optimization of absorbing sets and minimum Hamming distance distribution is proposed for NB-QC-LDPC codes with a maximum column weight not exceeding 3. Simulation results show that the constructed codes could achieve comparable or better FER compared to the recently proposed NB-QC-LDPC codes with the same codes parameters.

ACPPOEM-0725-3
High-Speed C-Band Transmission Using the Advanced Low-complexity Threshold-assisted Memory Polynomial Equalizer
Fei Xie[1], Xiaoqian Huang[1], Hengying Xu2, Yaojun Qiao[1]
1.Beijing University of Posts and Telecommunications, China; 2.Liaocheng University, China
In this paper, we firstly propose a threshold-assisted memory polynomial equalizer (TA-MPE), in which different thresholds are deployed in the memory polynomial equalizer (MPE) to combat inter-symbol interference (ISI) while significantly reducing computational complexity

ACPPOEM-0725-13
A CGAN-aided Autoencoder Supporting Joint Geometric Probabilistic Shaping for Optical Fiber Communication System
Yuzhe Li[1], Huan Chang[2], Qi Zhang[1], Xiangjun Xin[2], Gao Ran[2], Tian Feng[1], Qinghua Tian[1], Wang Fu[1], Li Zhipei[2]
1.Beijing University of Posts and Telecommunications, China; 2.Beijing Institute of Technology, China
An autoencoder supporting joint geometric and probabilistic shaping is proposed with aid of conditional generative adversarial network. Result shows that BER is reduced by 12% compared to a probabilistic shaping-only signal with the same entropy.

ACPPOEM-0726-20
Fiber Nonlinearity Compensation Using Deep Photonic Reservoir Computing
Yiwei Shen, Ruiqian Li, Guanting Liu, Jingyi Yu, Xuming He, Cheng Wang
ShanghaiTech University, China
We experimentally demonstrate a deep photonic reservoir computing architecture based on cascading injection-locked lasers. It is proved that the deep reservoir computing network with three layers well compensates the nonlinearity of optical fiber communication systems.

ACPPOEM-0726-24
A high-accuracy modulation format recognition scheme based on NFDM system
Jinwang Bai, Yongjun Wang, Xingyuan Huang, Lu Han, Haifeng Yang, Gang Feng
Beijing University of Posts and Telecommunications, China
This paper proposes a CNN aided MFR scheme for NFDM optical communication system, with a recognition accuracy of 99.5% under low OSNR and 100% under high OSNR.

ACPPOEM-0726-26
Deep Learning Based Free Space Optical Communication Diversity System
Hui Peng, Liqian Wang
Beijing University of Posts and Telecommunications, China
In this paper, a DL-based spatial diversity system for free-space optical (FSO) communication is proposed. Compared to traditional FSO spatial diversity systems that employ Maximum Ratio Combining (MRC), Equal Gain Combining (EGC), and Selection Combining (SC) techniques, the proposed system reduces system complexity while maintaining an acceptable performance. When simulating atmospheric turbulence with 16 turbulence states, the DL-based FSO diversity system achieves an operating time of 5.56s, whereas the traditional FSO diversity system requires 8.24s under the same conditions. In fact, turbulence states in the range of 200-300 are commonly employed to better emulate atmospheric channels. As the

number of turbulence states increases, the DL-based FSO diversity system demonstrates a more significant performance advantage in terms of operating time compared to traditional systems.

ACPPOEM-0727-10
Cable Capacity Optimization for Power-Limitted Submarine Transmission Systems
Yanpu Wang, Changwu Xu, Shao Yue, Lin Jiang, Li Jianping
HMN Technologies Co., Ltd., China
The capacity of the ultra-long-haul submarine cable system is limited by the power supply and electro-optical conversion efficiency. The system design needs to optimize cable current and the electro-optical efficiency of the repeater while considering the constraints of the power feed. This paper calculates and analyzes the optimized current of a typical transatlantic cable. It also analyzes the impact of bandwidth on pump conversion efficiency using Erbium-Doped Fiber Amplifier (EDFA) simulator. In contrast to conventional submarine cable systems, spatial division multiplexing (SDM) systems support a larger number of fiber pairs and operate at a lower optical power level, which is limited by the power supply. This paper compares the relationship between capacity and the number of fiber pairs with different bandwidths in transatlantic cables to determine the optimal number of fiber pairs.

ACPPOEM-0727-11
Impact of Modem's Link-Dependent Digital Impairments on Generalized Signal to Noise Ratio Measurement
Yanpu Wang, Jiang Lin, Quanying Wen, Jianping Li, Jingying Yu, Bangtian Xu
HMN Technologies Co., Ltd., China
This paper discusses the importance of Modem's Link-Dependent Digital Impairments (SNRi) in measuring the Generalized Signal-to-Noise Ratio (GSNR) in Open Cables, based on the ITU-T standard. It analyzes the key factors that affect SNRi and discusses the necessity of conducting actual measuring SNRi. This paper analyzes several factors that influence SNRi using the channel pre-emphasis SNRi test method. These factors include the accuracy of channel power measurement, Optical Signal-to-Noise Ratio (OSNR) measurement, Guided Acousto-optic Wave Brillouin Scattering (GAWBS) coefficient, and Back-to-Back (BTB) curve measurements. This paper discusses the feasibility of using multiple modems to test SNRi and GNSR based on a single BTB curve in order to improve efficiency and accuracy of testing. The point is proven through a test experiment conducted on a 6000km system.

ACPPOEM-0727-12
Unsupervised denoising assisted channel impairment compensation for next-generation optical access networks
Hong Guo, Hui Yang, pengcheng Deng, Li Chen, xiaoyu Lu
Southwest Jiaotong University, China
We propose a novel channel impairment compensation scheme that combines unsupervised denoising and Least Square equalizer for next-generation PONs. The results demonstrate the proposed scheme enhances the BER performance by improving OSNR of received signals.

ACPPOEM-0727-13
A Wide-Broadband Spectrum (110nm) Fabry-Perot Photodetector Enabling Cost-Efficient 10 Gb/s Optical Communications
Hao Zhong[1], Zhigang Cao[1], Zhijia Hu[1], Zichen Liu[2], Zhixue He[2], Chao Li[2]
1.Anhui University, China; 2.Peng Cheng Laboratory, China
We proposed a 110nm (1520nm~1630nm) broadband photodetector based on Fabry-Perot cavity and implemented it in a 10 Gb/s experimental wavelength-controllable optical wireless communication system over 3m link.

ACPPOEM-0727-19
Carrier-Assisted Ultra-Fast Phase Retrieval in Direct Detection DSCM System
Xiuquan Cui, Linsheng Fan, Jianyu Wang, Yuchen Jia, Jiexing Lin, Yong Yao, Yanfu Yang
Harbin Institute of Technology, Shenzhen, China
We report a strongly constrained phase retrieval (SC-PR) scheme for digital subcarrier multiplexing (DSCM) signals based on the Gerchberg-Saxton algorithm, which features fast convergence with less than 5 iterations and lowCSPR within 1dB.

ACPPOEM-0727-20
Roll-Off Insensitive and Robust Receiver IQ Skew Monitoring Based on Nonlinear Godard Algorithm for DSCM Systems
Yuchen Jia, Linsheng Fan, Qun Zhang, Xiuquan Cui, Siyu Gong, Jianyu Wang, Muqi Liu, Yong Yao, Yanfu Yang
Harbin Institute of Technology, Shenzhen, China
We report a receiver IQ skew monitoring scheme for coherent digital subcarrier multiplexing (DSCM) systems based on nonlinear Godard algorithm, which is insensitive to roll-off factors and robust to transceiver impairments and ASE noise.

ACPPOEM-0728-6
Experiment and field test of Raman amplifier based on 400G communication system
Zhang Chuanbiao, Tang Xiongyan, Shen Shikui, Zhang He, Shi Yan, Zhang Yejing, Hu Yakun, Tang Yu
China Unicom Research Institute, China
The performance optimization of Raman amplifier in 400G system is analyzed. Compared with the test in real fiber link, the quality of actual fiber link has a greater influence on Raman amplifier.

ACPPOEM-0728-22
Real-time Satellite Optical Terminal Prototype with 10Gbit/s Bidirectional Digital Video Transmission and Ranging Function
GongLewei[1], QuYuanzhe[1], SongYingxiong[1], WangShulei[1], ZhangQianwu[1,2], ZhangJunjie[1,2]
1.Shanghai University, China; 2.Teralink Optical Corporation (Shanghai), China
We demonstrate a real-time satellite optical terminal prototype with large-capacity communication and ranging function. A sensitivity of -41 dBm and ranging RMS of 0.039 cm is achieved at 10 Gbit/s bidirectional transmission.

ACPPOEM-0728-27
A Low Complexity Nonlinear Equalizer Based on Wavelet Clustering Algorithm
Xiying Ding, Yongjun Wang, Xingyuan Huang, Lu Han, Dewen Chen, Chao Li
Beijing University of Posts and Telecommunications, China
A nonlinear equalization technique based on grid retrieval wavelet clustering algorithm is proposed and verified in the 16-QAM coherent optical communication system. Compared with other iterative clustering algorithms, wavelet clustering has lower linear time complexity.

ACPPOEM-0728-30
Long-haul optical chaos synchronization employing optical phase conjugation
Liang Li, Anlin Yi
Center for Information Photonics & Communications, School of Information Science and Technology Southwest Jiaotong University, China
Optimization of launching power, fiber transmission-distance, linewidth of the pump laser in the OPC module are well studied. Finally, an up to 2240-km chaos synchronization with a synchronization coefficient beyond 0.9 is obtained.

ACPPOEM-0728-34
An Improved Hybrid Switching Scheme for UAV-to-Ground ACM FSO System
Qianwu Zhang[1], Boyang Liu[1], Guanwen Chen[1], Shucheng Zhan[1], Zhiyu Li[1], Jing Zhang[2], Ning Jiang[2], Bingyao Cao[1], Zhengxuan Li[1]
1.Shanghai University, China; 2.University of Electronic Science and Technology of China, China
An improved hybrid switching scheme is proposed for UAV-to-Ground ACM FSO system. Simulation results show SNR switching threshold deviation is reduced by 3.65 dB in strong turbulence.

ACPPOEM-0729-16
Semi-Supervised Feature-Crosses Neural Network Equalizer In Fiber Optics
Rui Yang[1,2,3], Qi Zhang[2,3,4], Xiangjun Xin[5,6], Fu Wang[2,3,4], Jinkun Jiang[1,2,3], Feng Tian[2,3,4], Qinghua Tian[2,3,4], Yongjun Wang[2,3,4], Leijing Yang[2,3,4]
1.School of Electronic Engineering, China; 2.Beijing Key Laboratory of Spaceground Interconnection and Convergencet, China; 3.Beijing University of Posts and Telecommunications, China; 4.State Key Laboratory of Information Photonics and Optical Communications, China; 5.School of Information and Electronics, China; 6.Beijing Institute of Technology, China
In this paper, a semi-supervised feature-crosses nonlinear equalization(FC-NLE) scheme with adaptive threshold regulation and consistency regularization is proposed to compensate for the linear and nonlinear impairment in the high-speed optical communication systems.

ACPPOEM-0730-10
Real-time 3.4-Gbit/s DMT-VLC transmission with block precoding techniques
Jie Zhou[1], Ming Chen[1], Xu Gao[1], Rui Deng[2]
1.Hunan Normal University, China; 2.Huachang Chip-lighting Co., Ltd, China
We experimentally demonstrated two block precoding techniques for real-time DMT and red LED-based VLC systems, and the real-time 3.4-Gbit/s DMT signal can transmit over a 2.3-m free-space link with the BER below 1e-3.

ACPPOEM-0730-11
A stepped low density parity check codes punching algorithm based on multiple check matrices
Xie Rongzhen[1,2], Zhang Qi[2,3], Xin Xiangjun[4,5], Wang Fu[2,3], Tian Feng[2,3], Tian Qinghua[2,3], Wang Yongjun[2,3], Yang Leijing[2,3], Jiang Jinkun[1,2]
1.School of Electronic Engineering, China; 2.Beijing University of Posts and Telecommunications, China; 3.Beijing Key Laboratory of Space-Ground Interconnection and Convergence, China; 4.The Advanced Research Institute of Multidisciplinary Science, China; 5.Beijing Institute of Technology, China
A stepped low density parity check (LDPC) codes punching algorithm based on multiple check matrices is proposed. The proposed scheme is more flexible to realize the adaptive rate under Gaussian white channel. In a 100Gbit/s optical communication simulation system, the proposed algorithm has about 0.49dB gain after 1000km of transmission, compared to the general punching algorithm.

ACPPOEM-0730-12
Non-Recursive Algorithm for Bounded-energy Trellis Computation in Enumerative Sphere Shaping
Jinkun Jiang[1], Qi Zhang[1], Xiangjun Xin[2], Ran Gao[2], Fu Wang[1], Zhipei Li[2], Feng Tian[1], Qinghua Tian[1], Yongjun Wang[1]
1.Beijing University of Posts and Telecommunications, China; 2.Beijing Institute of Technology, China
A non-recursive energy-free bounded-energy trellis calculation algorithm is proposed in this paper. Based on the derivation of the recursive relationship of the trellis nodes, a non-recursive calculation method is applied, and energy-related calculations are removed, thereby reducing the computational complexity. The results of complexity analysis and numerical simulation show that under different block lengths, maximum energy, and amplitude alphabet size, lower complexity always be

achieved by the proposed algorithm.

ACPPOEM-0730-15
Sparse Bayesian Learning-based Channel Estimation for Indoor OTFS Visible Light Communication
Yuxuan Liao[1], Jianhua Pei[1], Weijie Dai[1], Jian Song[1,2,3], Yuhan Dong[1,3]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Department of Electronic Engineering, Tsinghua University, China; 3.Peng Cheng Laboratory, China
Benefiting from the sparse representation of channels in the delay-Doppler (DD)-domain, orthogonal time-frequency space (OTFS)-based visible light communication (VLC) systems can compensate different channel impairments to detect transmitted symbols with the knowledge of channel state information (CSI). However, in prior OTFS-based VLC works, the effective channel estimation method has not been fully explored yet. In this paper, we derive the relation equation between the channel impulse response (CIR) and the received DD-domain pilot signal subblock to provide an efficient channel estimation method based on sparse Bayesian learning (SBL) algorithm. Numerical results have shown that the proposed embedded pilot-aided DD-SBL channel estimation scheme significantly outperforms other conventional methods in terms of estimation accuracy and bit error rate (BER) performance for practical scenarios.

ACPPOEM-0730-21
Underwater Real-time Mobile Duplex Video Transmission Using Visible Light
Jiehui Liu, Lin Ma, Zuyuan He
Shanghai Jiao Tong University, China
We demonstrate an underwater visible light mobile communication system at 5.0 Mb/s data rate while moving at 0.21 m/s. Real-time duplex video transmissionwas achieved at a distance ranging from 1.3 m to 5.6 m.

ACPPOEM-0730-28
20Gbps Free-Space Optical Chaotic Communication Based on Orbital Angular Momentum Multiplexing
Yiqun Zhang[1], Ning Jiang[1], Anran Li[1], Mengjie Zhou[2], Shuangcheng Chen[2], Jiazheng Ding[2], Gang Hu[1], Yongsheng Cao[1], Kun Qiu[1]
1.University of Electronic Science and Technology of China, China; 2.Tianfu Xinglong Lake Laboratory, China
We experimentally demonstrate a free-space all-optical chaotic communication system that enhances transmission capacity and security by orbital angular momentum (OAM) multiplexing. Optical chaotic signals with two different OAM modes carrying 20 Gbps on-off keying signals are secretly transmitted over a 2 m free-space link. Our work may inspire structured light application in optical chaos and pave a new way for developing future high-capacity free-space chaotic secure communication systems.

ACPPOEM-0730-30
Wasserstein Autoencoder based End-to-End learning strategy of geometric shaping for an OAM mode division multiplexing IM/DD transmission
Zhaohui Cheng[1], Ran Gao[1], Qi Xu[1], Fei Wang[1], Yi Cui[2], Xiangjun Xin[1]
1.Beijing Institute of Technology, China; 2.Beijing University of Posts and Telecommunications, China
We propose a Wasserstein Autoencoder based end-to-end geometric shaping scheme for IM/DD OAM-MDM optical fiber communication system. Compared with traditional autoencoder, the BER decreased by up to 28% and 33% with two OAM modes.

ACPPOEM-0730-32
Baud-rate and IQ skew tolerant timing recovery for short-reach coherent optical interconnection
Siyu Gong[1], Yanfu Yang[1], Qian Xiang[2], Jianhua Liu[2], Qun Zhang[2], Tianjian Zuo[2]
1.Harbin Institute of Technology, Shenzhen, China; 2.Huawei Technologies Co., Ltd, China
A baud-rate timing recovery scheme with PN sequence synronization is proposed. Compared to traditional scheme, the compensation capability of sampling phase error and IQ skew in our scheme is confirmed by both simulation and experiment.

ACPPOEM-0730-33
Hybrid Probabilistic and Geometric Constellation Shaping for Phase Noise Channels with an Improved Differentiable Blind Phase Search
Liu Zhiyang, Liu Xiaoyu, Xiao Shilin, Yang Weiying, Hu Weisheng
Shanghai Jiao Tong University, China
We perform hybrid probabilistic and geometric constellation shaping in a phase noise channel using bitwise end-to-end learning with an improved two-stage differential blind phase search. The proposed approach reduces computational complexity with favorable performance.

ACPPOEM-0730-36
On Propagation of OAM Modes carried by Partially Coherent Laguerre-Gaussian Beams in Weak Oceanic Turbulence with Wide Range Parameters
Weijie Dai[1], Yuxuan Liao[1], Yize Zhang[1], Yuhan Dong[1,2]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Peng Cheng Laboratory, China
In this work we consider the propagation properties of orbital angular momentum (OAM) modes carried by partially coherent Laguerre-Gaussian beams (PCLGB) in weak oceanic turbulences of wide range where the average temperature varies from 0 to 30 degrees of Celsius and the average salinity varies from 0 to 40 part per thoUnited Statesnd, which stand available for describing most scenarios in realistic oceanic environments. By utilizing the oceanic turbulence optical power spectrum capable of describing wide range oceanic optical turbulence into the propagation of PCLGB, we evaluate the cor-

responding turbulent coherent length, the detection and crosstalk probabilities of OAM modes, constituting the direct and vital metrics in OAM-based underwater wireless optical communication systems, for which our results offer assessments of metrics and provide instructions under wide range parameters

ACPPOEM-0730-45
Dual-Mode Spatial Division Multiplexing with Geometric Constellation Shaping for UVLC
Wang Jiwei[1], Chen Chen[1], Deng Bohua[2], Liu Min[1], He Cuiwei[3], Fu H. Y.[2]
1.Chongqing University, China; 2.Tsinghua University, China; 3.Japan Advanced Institute of Science and Technology, Japan
A dual-mode spatial division multiplexing (DM-SDM) scheme with geometric constellation shaping (GCS) is proposed for underwater visible light communication (UVLC) systems. Simulation and experimental results successfuly verify the superiority of DM-SDM with GCS for UVLC.

ACPPOEM-0730-46
Performance Analysis of Adaptive Optics in Turbulence Compensation with WFS for Synthetic Aperture Lidar Imaging
Chao Chen, Yan Li, Hongxu Song, Xiaobin Hong, Hongxiang Guo, Jian Wu
State Key Laboratory of Information Photonics and Optical Communication, Beijing University of Posts and Telecommunications, China
Synthetic aperture lidar (SAL) is a widely used radar system, and the quality of its imaging is greatly affected by atmospheric turbulence during transmission. The use of adaptive optics (AO) systems can effectively improve the imaging quality. In this paper, we constructed a SAL simulation system based on wavefront sensing (WFS) and studied its imaging quality. The simulation results show that the adaptive optics system with WFS can effectively improve the imaging signal-to-noise ratio (SNR) of the system, and has almost no negative impact on its imaging resolution.

ACPPOEM-0731-1
A Low-Complexity Adaptive Equalizer for Field PDM-PAM4 with Coherent Detection
Yuyuan Gao, Zhou Xian, Wang Shiyao, Fang Qianwen
Univesity of Science and Technology Beijing, China
A low-complexity equalization based on SP-LMS iteration is proposed to compensate the IQ imbalance of field modulated PAM4 signals. This algorithm reduces the complexity compared to conventional algorithms. Further, the IQ amplitude phase imbalance can be estimated based on the tap coefficients of the first stage.

ACPPOEM-0731-5
22.5 Gbps UOWC Using WDM/PolM and OFDM with Interleaved Subcarrier Number Modulation
Chen Jiamin[1], Deng Bohua[2], Chen Chen[1], Fu H. Y.[2]
1.Chongqing University, China; 2.Tsinghua University, China
A 22.5-Gbps UOWC system using WDM/PolM is demonstrated, where OFDM with interleaved subcarrier number modulation (OFDM-ISNM) is proposed to extend the United Statesble bandwidth. Experimental results show a 78.6% bandwidth extension by OFDM-ISNM compared with OFDM.

ACPPOEM-0731-12
Multi-level Decomposition Enumerative Sphere Shaping Scheme for Short Blocklengths
Xuezhen Wang, Lishan Yang, Chenglin Bai, Hengying Xu, Danping Pan, Weibin Sun, Yining Zhang, Zukai Sun, Pengfei Li
Liaocheng University, China
The Multi-level Decomposition Enumerative Sphere Shaping Scheme proposed in this paper reduces the average amplitude energy and rate loss of traditional ESS, while also improving the OSNR gain without increasing complexity.

ACPPOEM-0731-14
DP-16QAM and DP-QPSK Coherent Links for 1.6Tb/s in O-band
Yao Chaonan[1], Zhu Yanjun[2], Zhang Hua[1]
1.Hisense Broadband Multimedia Technologies Co., Ltd., China; 2.Hisence Broadband Inc., United States
We report results of 800 Gb/s (1.6 Tb/s with 2 lanes, for DP-16QAM) and 400 Gb/s (1.6 Tb/s with 4 lanes, for DP-16QAM and DP-QPSK) with transmission link from 2 km to 20 km at O-band. For 1.6 Tb/s interface bandwidth, 400 Gb/s per lane with DP-QPSK technology has potential advantages for LR reach applications, while 800 Gb/s per lane (for DP-16QAM) extends these advantages for scaling the interconnect (interface) bandwidth efficiently beyond 1.6Tb/s.

ACPPOEM-0731-21
CNN Based Input Power Optimization for S , C and L Wide-band Transmission Systems
Han Li, Wu Liu, Hong Li, ZhiYi Zhong, Ming Luo
State Key Laboratory of Optical Communication Technologies and Networks, China
Based on CNN, we estimate the optimal input power with given output power for 186 S+C+L channels in a 160 km 2-span amplification link and the estimation MAE is 0.19dB.

ACPPOEM-0731-27
A Deep Neural Network-Based Split-Step Decoding Algorithm in Optical Spatial Modulation System
Minghua Cao, Xiangwen Ye, Yue Zhang, Ruifang Yao, Zhihao Li, Huiqing Wang
Lanzhou University of Technology, China
In order to address the issues of low transmission rate and low spectral efficiency in existing optical spatial modulation, we propose a Deep Neural Network (DNN)-based split-step decoding algorithm for optical spatial pulse position modulation Faster-Than-Nyquist (OSPPM-FTN) scheme to achieve near optimum performance with low-complexity. Additionally, we derive the theoretical upper bound of bit error rate (BER) for the OSPPM-FTN system under the Gamma-Gamma turbu-

lence channel and validate its reliability using Monte Carlo method. Simulation results demonstrate that compared to existing OSPPM at acceleration factor τ=0.9, the OSPPM-FTN scheme achieves higher spectral efficiency and transmission rate by 0.17 bit/s/Hz and 0.22 bpcu respectively, albeit with a loss of approximately 1 dB in signal-to-noise ratio (SNR). Moreover, our proposed decoding algorithm exhibits 42% lower computation complexity than the maximum likelihood (ML) algorithm.

ACPPOEM-0731-31
250m Daytime Real-time LED-OWC System
Wang Shulei[1], Qu Yuanzhe[1], Chen Jian[1], Yu Zongbi[1], Chen Yanhao[1], Yuan Yongchun[2], Yuan Shidong[2], Zhang Qianwu[1,3], ZhangJunjie[1,3]
1.Shanghai University, China; 2.Shanghai Institute of Technical Physics Chinese Academy of Sciences, China; 3.Teralink Optical Corporation (Shanghai), China
We have demonstrated a simple LED-OWC system based on FPGA. From the indoor and field tests, the real-time extreme communication sensitivity and transmission distance at 1Mbps OOK are of -41.93dBm and 250m respectively.

ACPPOEM-0731-53
On the PMD Impact of Dual-Polarization Direct Detection with Jones-Space Optical Field Recovery
Qi Wu[1,2], Yixiao Zhu[1,2], Hexun Jiang[1], Zhaopeng Xu[2], Honglin Ji[2], Yu Yang[2], Gang Qiao[2], Shangcheng Wang[2], Lulu Liu[2], Junpeng Liang[2], Jinlong Wei[2], Jiali Li[2], Zhixue He[2], Qunbi Zhuge[1], Weisheng Hu[1,2]
1.Shanghai Jiao Tong University, China; 2.Peng Cheng Laboratory, China
We theoretically extend the concept of proposed Jones-space optical field recovery to the all-order polarization mode dispersion model for short-reach direct detection optical fiber communications. We numerically verify the impact of polarization mode dispersion can be mitigated using linear equalization as coherent detection systems with a 56-GBd dual-polarization QPSK, 16-QAM, and 64-QAM simulation.

ACPPOEM-0731-55
Low Latency and Resource Consumption Phase Recovery for Real-time Inter-satellite QPSK Optical Communications
Yanhao Chen[1], Yuanzhe Qu[1], Junjie Zhang[1], Lewei Gong[1,2], Qianwu Zhang[1,2], Yingxiong Song[1,2]
1.Shanghai University, China; 2.Teralink Optical Corporation(Shanghai), China
We propose a real-time QPSK phase recovery method. Compared with conventional CORDIC system, the latency and resource consumption are reduced by 83.87% and over 64%, while the sensitivity is improved by 0.3 dB.

ACPPOEM-0731-57
Enhanced Transmission Rate and Reach for POF-based VLC system with Probabilistic Shaping PAM-8
Yibin Li, Zixian Wei, Bohua Deng, H. Y. Fu
Tsinghua University, China
PS-PAM-8 is experimentally demonstrated to improve transmission performance of the POF-based VLC system, i.e., enhancing the transmission rate by 28% and transmission reach up to beyond 50 m.

ACPPOEM-0731-84
Neural hierarchical network based channel emulator for IM/DD OAM mode division multiplexing optical fiber communication system
Fulin Yang[1], Ran Gao[2], Qi Xu[2], Fei Wang[2], Qi Zhang[3], Xiangjun Xin[4]
1.School of Electronic Engineering Beijing University of Posts and Telecommunications, China; 2.School of Information and Electronics Beijing Institute of Technology, China; 3.Beijing Key Laboratory of Space-Ground Interconnection and Convergence, China; 4.School of Information and Electronics Beijing Institute of Technology, China
We propose and experimentally demonstrate a novel channel emulator based on neural hierarchical network for OAM-MDM system. Compared withCGAN emulator, it improves the modeling accuracy by 34.5% and 35.3% for two OAM modes, respectively.

ACPPOEM-0731-89
Pilot-Aided Deep Learning based Phase Estimation forOFDM Systems with Wiener Phase Noise
Qian Wang[1], Xingke Chen[1], Liping Qian[1], Xinwei Du[2], Changyuan Yu[3], Pooi-Yuen Kam[4]
1.Zhejiang University of Technology, China; 2.BNU-HKBU United International College, China; 3.The Hong Kong Polytechnic University, Hong Kong, China; 4.The Chinese University of Hong Kong (Shenzhen), China
Orthogonal frequency-division multiplexing (OFDM) and high-order modulations have a wide range of applications in coherent optical communications. However, the existence of phase noise will greatly affect the system performance. To overcome this issue, this paper proposes a pilot-aided deep learning (PADL)-based phase estimation scheme, since deep learning has been a hot trend to be applied on digital signal processing in communications. To be specific, preliminary phase noise is first estimated by the pilot-aided (PA) method, and then the estimates are fed into the neural network to train for more accurate estimation. Simulation results show that the mean square error performance of the proposed method is much better than the conventional PA method. Especially for high-order modulations (M≥64), the bit error rate of the PADL-based receiver is smaller than that with even double pilots used for phase estimation, which verifies a stronger robustness in our design using limited spectrum resources.

ACPPOEM-0731-94
The Effect of Coupling Offset to VCSEL-MMF Links for Short-reach Optical Communications
Zijing Huang, Ning Liu, Lin Sun
School of Electronic and Information Engineering Soochow University, China
We investigated the transmission of 100-Gb/s PAM4 signals using 850-nm VCSELs over 150-m MMFs with lateral offsets. The oxide aperture size of VCSEL, coupling loss and modal dispersion induced by misalignments are evaluated by simulations.

ACPPOEM-0731-102
Modified Long Short-term Memory For OpticalFiber Channel Modeling
Xingwang You[1], Huan Chang[2], Ran Gao[2], Qi Zhang[1], Sitong Zhou[2], Dong Guo[2]
1.Beijing University of Posts and Telecommunications, China; 2.Beijing Institute of Technology, China
For fiber channel modeling, compared with traditional LSTM, the proposed modified LSTM-aided technique can alleviate the gradient explosion problem with a higher modeling accuracy, making it more suitable for assisting in fiber channel modeling.

ACPPOEM-0731-114
A Noise performance optimization method for SBS-based optical spectrum analyzer
Zi Liang[1,2], Changjian Ke[1,2], Yuming Zhang[1,2], Yanjun Lv[1,2], Deming Liu[1,2]
1.School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.National Engineering Research Center of Next Generation Internet Access-system, Huazhong University of Science and Technology, China
A noise performance optimization method for SBS-based OSA is proposed and experimentally proved. By adjusting the working state of the spectrometer system, the optimized sensitivity can be reduced by ~5dB.

ACPPOEM-0731-122
Suppression for laser phase noise in phase-stabilized transmission systembased on phase conjugation
Tao Wang[1], Chen Tian[1], Shangyuan Li[2], Jinyang Liu[1], Zhengyang Xie[1], Xin Zhao[1], Zheng Zheng[1]
1.Beihang University, China; 2.Tsinghua University, China
In this paper, a phase conjugation-based method for suppressing the phase noise of the laser in the phase-stabilized transmission system is proposed. As a result, the phase noise of the far-end radio-frequency (RF) signal is optimized.

ACPPOEM-0731-127
Transmission link OSNR monitoring based on data-aided carriers
ZhangHao, ZouXinhang, ZhaoWanqi, ZhengZhennan, GaoXinlu, HuangShanguo
Beijing University of Posts and Telecommunications, China
Monitoring the optical signal-to-noise ratio (OSNR) of optical communication transmission links is very important for optical networks dynamic operation. We propose a low-cost OSNR monitoring scheme based on data- aided carriers. In the scheme, narrowband low-power data- aided carriers are introduced at the boundary of WDM grids, achieving high precision OSNR monitoring without interfering with network transmission service. The simulation results show that the data-aided carrier with 0.1% service signal power has high estimation accuracy under different OSNR, and the estimated standard deviation is very stable, reaching 0.1.

ACPPOEM-0731-133
Modeling of Multi-Core Fiber Channel Based on M-CGAN for High Capacity Fiber Optical Communication
Maming, Changhuan, Gaoran, Guodong, Liuxinyu, Yuanmengzhu
Beijing Institute of Technology, China
This paper proposes a modified conditional generative adversarial network (M-CGAN) aided channel modeling technique for multi-core fiber (MCF) communication systems. The results show that the proposed M-CGAN can achieve better modeling performance for MCF communication.

ACPPOEM-0731-134
Experiment demonstration of OFDM-based VLC systems with low-resolution DAC
Siyu Bai[1], Yibin Li[1], Zixian Wei[1], Chen Cheng[2], Yanfu Yang[2], H.Y. Fu[1]
1.Tsinghua University, China; 2.Harbin Institute of Technology, China
We demonstrate a 1-m free-space VLC system with low-resolution DAC based OFDM, prove ACO-OFDM outperforms than DCO-OFDM in low-resolution modes. Results reveal that DRE can significantly improve the BER performance of low-resolution based OFDM system.

ACPPOEM-0731-138
Adaptively Biased Optical OTFS For Power-constrained Visible Light Communication
Jianhua Pei[1], Yuxuan Liao[1], Rui Wang[1], Jian Song[1,2,3], Yuhan Dong[1,3]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Department of Electronic Engineering, Tsinghua University, China; 3.Peng Cheng Laboratory, China
Direct current biased optical orthogonal time frequency space (DCO-OTFS) scheme suffers relatively low power efficiency for the large DC bias due to the high peak to average power ratio (PAPR) of OTFS. Thus, it is not suitable for power-constrained scenarios. In this paper, we propose a power efficient adaptively biased optical OTFS (ABO-OTFS) scheme whose DC bias can be dynamically adjusted according to the signal samples at some specific positions. Numerical results have shown that the proposed ABO-OTFS has better bit error rate (BER) performance, lower PAPR, and higher power efficiency than existing DCO-OTFS.

ACPPOEM-0731-141
Robust Polar coordinate system-based KNN algorithm suitable for FSO communication systems with turbulence distortions
Xishuo Wang[1], Kai Lv[1], Xiaolong Pan[2], Qi Zhang[3], Xiangjun Xin[2], Xiaoli Huo[1], Ruiquan Jing[1]
1.China Telecom Research Institute, China; 2.Beijing Institute of Technology, China; 3.Beijing University of Posts and Telecommunications, China
A Polar KNN classification algorithm suitable for turbulence-distorted QAM signals is proposed, which can robustly achieve optimized decision at low training lengths. Simulation results show that, the proposed algorithm can achieve 23% transmission distance improvement.

ACPPOEM-0731-154
Automatic Bias Control for PPM-based Free Space Optical Communication Systems
Chenchen Ding, Ziyuan Shi, Yang Sun, Xiaowei Wu, Lei Yang
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China
Pulse position modulation (PPM) is widely adopted by free space laser communication system due to high energy efficiency. The performance of PPM-based system is greatly affected by the extinction ratio (ER) of optical transmitter due to the fact that ER contributes to a non?negligible proportion of background noise. In this paper, we present a practical automatic bias control (ABC) algorithm to maximize ER of optical PPM signal and build a experimental demonstration system. The experiments show that the proposed ABC algorithm can retain ER at 24 dB during a long continuing operation.

ACPPOEM-0731-165
Shaping Distribution Identification of Probabilistic Shaping QAM Signals Based on Higher-order Cumulants
Hongye Li[1], Zhou Gan[1], Yuxuan Liao[1], Xinke Tang[2], Yuhan Dong[1,2]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Peng Cheng Laboratory, China
We propose a shaping distribution identification method for classifying shaping rate of PS-MQAM signals, which combines higher-order cumulants with threshold classifiers. Results showthat when SNR is higher than 9dB, classification accuracy can reach 100%.

ACPPOEM-0731-167
Low-complexity channel prediction based on retroreflection of auxiliary beam and deep learning for free-space optical communication systems
Hengrui Liu, Shanyong Cai
State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China
In this paper, a low-complexity channel prediction scheme for adaptive FSO systems based on auxiliary beam retroreflection and deep learning is proposed. Additionally, we explore the use of prediction model based on the Conv-GRU network.

ACPPOEM-0731-175
A Low-Complexity Neural Network Equalizer Based on Symbol Classification for VLC System
Shupeng Li, Yi Zou
South China University of Technology, China
In this paper, we propose a symbol classification multilayer perceptron (SC-MLP) equalization scheme for the VLC system based on the degree of signal impairment. Particularly, we propose a low complexity neural network equalizer without sacrificing the optimal performance. Experimental results show that the performance of the SC-MLP scheme is comparable to that of MLP equalizer at the optimal working point with a complexity reduction of 67.7%.

ACPPOEM-0801-4
Phase Recovery of Probabilistically Shaped 1024-QAM Signals
Xinbang Han, Mingyi Gao, Xin Shi, Xuejing Huang, Xiaodi You, Gangxiang Sheng
School of Electronic and Information Engineering, Soochow University, China
The phase recovery algorithms are investigated in PDM PS-1024QAM coherent optical transmission system. The NGMI is experimentally measured to verify the feasibility of the V-V QPSK phase recovery algorithm.

ACPPOEM-0801-11
A DSP-Based Monitor Algorithm For Time-Varying Trajectory and Rotation Speed of Principal States of Polarization
Zhang Bin, Ji Chenxi, Zhao Jiarun, Cui Nan, Tang Xianfeng, Zhang Xiaoguang
Beijing University of Posts & Telecommunications, China
We propose a DSP-based algorithm for monitoring PSP trajectories and rotation speeds. By using sliding-window median-filtering and modulus judgment method, the algorithm can precisely recover the PSP trajectories and determine the rotation speeds more accurately.

ACPPOEM-0801-16
Numerical study of 1.6T IM/DD Transmission Based on LWDM Grid using 200G/lane over 2-5 km of Standard Single Mode Fibers
Adrian A. Juarez[1], Yanjun Zhu[2], Xin Chen[1], Ming-Jun Li[1]
1.Corning Inc., United States; 2.Hisense Broadband Inc., United States
1.6T IM/DD transmission based on LWDM grid using 200G/lane over 2-5 km of SSMFis studied. The impact of FWM is assessed for different fiber distances showing marginal impact if statistical laser variations are considered.

ACPPOEM-0801-19
Impact of FWM on O-Band CW-WDM Links for High-Capacity, Low-Latency Data Center Applications
Adrian A. Juarez[1], Andreas Matiss[2], Sergey Ten[1], Pushkar Tandon[1]
1.Corning Inc., United States; 2.Corning Optical Communications, Germany
The impact of Four-Wave-Mixingis analyzed for CW-WDM data-center architecture interconnects that rely on low latency and low Bit-Error-Rates. This analysis shows that novel dispersion-shifted-fibers are advantageous and extend the reachup to 15 km.

ACPPOEM-0801-22
A Time-Domain Carrier Frequency Offset Estimation Algorithm Based on the Power of Zero-Subcarriers for CO-OFDM Systems
Jiaxin Yan[1], Taowei Jin[1], Xinwei Du[2], Jing Zhang[1], Shaohua Hu[1], Kun Qiu[1], Qi Yang[3]
1.University of Electronic Science and Technology of China, China; 2.Guangdong Provincial Key Laboratory of Interdisciplinary Research and Application for Data Science BNU-HKBU United International College, China; 3.Huazhong University of Science and Technology, China
We propose a simple, full-range, and low-latency frequency offset estimation method based on the moving average filter bank in the time domain for CO-OFDM transmission systems. Simulation results validate its feasibility.

ACPPOEM-0801-26
Simplified Coherent Reception Enabled by Alamouti Coding and Digital Subcarrier Multiplexing Technology
Wei Wang[1], Dongdong Zou[1], Zhenpeng Wu[1], Fan Li[1], Xingwen Yi[1], Chao Lu[1], Zhaohui Li[1], Qi Sui[2]
1.Sun Yat-sen University, China; 2.Southern Marine Science and Engineering Guangdong Laboratory, China
In this paper, a simplified self-coherent system achieved by Alamouti coding and digital subcarrier multiplexing technology is proposed. The transmission of 50Gbaud 4-subcarrier 16QAM signal over 40km single mode fiber is experimentally demonstrated.

ACPPOEM-0801-30
Joint Timing and Frequency Synchronization for Coherent Optical SEFDM Systems
Jinze Shi[1], Xinwei Du[1], Shuai Liu[1], Qian Wang[2], Changyuan Yu[3]
1.BNU-HKBU United International College, China; 2.Zhejiang University of Technology, China; 3.The Hong Kong Polytechnic University, Hong Kong, China
In this paper, we propose a joint timing and frequency synchronization algorithm for spectrally efficient frequency-division multiplexing (SEFDM) systems by utilizing a training symbol composed of a conjugate symmetric sequence.

ACPPOEM-0801-62
Experimental demonstration of time-frequency transmission in a 22.5 km 7-core fiber link
Jing Zhang[1,2], Feng Tian[1,2,3], Xiaodong Liu[4], Tianze Wu[1,2], Qi Zhang[1,2,3], Xuanzhi Gan[1,2]
1.State Key Laboratory of Information Photonics and Optical Communications, China; 2.School of Electronic Engineering, Beijing University of Posts and Telecommunications, China; 3.Beijing Key Laboratory of Space-ground Interconnection and Convergence, BUPT, China; 4.Beijing Arcoren Science & Technology Co.,LTD, China
We experimentally demonstrated a 22.5 km stable optical time-frequency transmission system using 7-core fiber, achieving a time-synchronization accuracy of ±625 ps, time stability of 5 ps, and frequency stability of 6.23E-14/1000s, verifying the potential of multicore fibers for application in optical stable time-frequency transmission."

ACPPOEM-0801-68
19.02Gbps/25m Underwater Wireless Optical Communication Adopting Probabilistic Constellation Shaping QAM-DMT Transmission
Tianyi Zhang[1], Jiahan Tian[1], Yuan Wang[1], Chao Fei[1], Junwei Zhang[2], Fei Zhang[1], Yitong Xie[1], Guowu Zhang[1], Gaoxuan Wang[1], Ji Du[1], Xiaojian Hong[1], Sailing He[1,3]
1.Zhejiang University, China; 2.The Hong Kong Polytechnic University, Hong Kong, China; 3.Royal Institute of Technology, Sweden
We experimentally demonstrated probabilistic constellation shaping quadrature amplitude modulation discrete multitone (PCS QAM-DMT) for 25-m underwater wireless optical communication (UWOC) system with a net data rate of 19.02Gbps. 28.1% capacity improvement is achieved in comparison with conventional bit-power loading DMT scheme. To the best of our knowledge, this is the highest net data rate ever reported for a single LD in current UWOC.

ACPPOEM-0801-92
3.078 Tb/s (162-Gb/s×19) PAM-8 Transmission Based on 1-km 19-core Fiber Using Liquid Time-Constant Networks
Runzhe Fan, Chao Yang, Ming Luo
State Key Laboratory of Optical Communication Technologies and Networks, China
This paper uses liquid time-constant neural networks to perform nonlinear equalization on the 3.078-Tb/s PAM-8 transmission system on a 1-km 19-core single-mode fiber.

ACPPOEM-0801-102
Neural Network Equalizer with Gate Control Mechanism in High-Speed PAM4 Short-reach Optical System
Chen Hui, Jin Siyue, Li Chao, Wang Qibing, Liu Zichen, Wang Lei, He Zhixue
Peng Cheng Laboratory, China
We proposed an untraditional neural network equalizer with gate control mechanism to compensate the severe impairments in over 100Gbit/s PAM4 bandwidth-limited short-reach optical system, with enhanced equalization performance and around 45% complexity reduction.

ACPPOEM-0801-107
A Two-Step Pilot-based Phase Noise Suppression Method for Optical Universal Filtered Multi-carrier Systems
Liu Shi
Beijing Electronic Science and Technology Institute, China
In this paper,we propose a novel two-step pilot-based phase noise suppression method for optical UFMC. The proposed method enhances the suppression and robustness of phase noise caused by the laser. The effectiveness of the method is demonstrated through a large number of Monte Carlo experiments.

ACPPOEM-0801-122
Fast and High-Robustness Adaptive Digital Back-Propagation for Fiber Nonlinearity Compensation
Yi Liu[1], Mingqing Zuo[2], Dong Wang[2], Zhengyang Xie[1], Xin Zhao[1], Zheng Zheng[1], Shan Cao[2], Yunbo Li[2], Dechao Zhang[2], Han Li[2]
1.Beihang University, China; 2.China Mobile Research Institute, China
RMSProp-based digital back-propagation is proposed for blind nonlinearity compensation. Compared with conventional method, 69.8% reduction in complexity and at least 46.1% improvement in robustness are demonstrated in a simulation of 2000-km 69-GBd DP-16QAM transmission.

ACPPOEM-0801-137
Autonomous Obstacle Avoidance and Communication Capacity Optimization for UAV-Assisted VLC Systems
Liang Li[1], Jiawei Hu[1], Xinke Tang[2], Yuhan Dong[1,2]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Peng Cheng Laboratory, China
Unmanned aerial vehicles (UAVs) have broad application potential in communication systems, especially those equipped with visible light communication (VLC) systems, which can provide high-rate information transmission and illumination services simultaneously. This paper proposes UAV-assisted VLC systems based on deep Q-network (DQN), which use deep reinforcement learning (DRL) algorithm to achieve autonomous obstacle avoidance and communication capacity maximization of UAVs. This paper focuses on the dynamic trajectory planning problem of UAVs in complex obstacle scenarios, considering factors such as obstacle collision risk and line of sight (LoS) communication quality, and designs a reasonable DRL reward function. Through simulation experiments, the effectiveness and feasibility of the system and algorithm proposed in this paper are verified.

ACPPOEM-0801-138
A Novel MIMO method for Few-mode Multi-core Optical Transmission System based on Modify Frequency Domain
Ren Zhihao, Wang Yongjun, Huang Xingyuan, Han Lu, Li Chao, Zhang Qi
Beijing University of Posts and Telecommunications, China
A Multiple-Input Multiple-Output equalization based on the Frequency Domain Modify Cascaded Multimode Algorithmis proposed in this paper, and experimentally demonstrated in the few-mode multi-core transmission with capacity of 210 Gb/s.

ACPPOEM-0802-4
Central Carrier-Assisted Phase Retrieval Scheme Based on Parallel Alternative Projections GS Algorithm
Pengfei Li, Chenglin Bai, Yu Zhang, Wanxiang Bi, Fan Yang, Hengying Xu, Lishan Yang, Xuezhen Wang, Peng Qin
Liaocheng University, China
The PR receiver with multiple parallel dispersive elements is constructed for the first time, and a novel scheme combining parallel alternative projections GS algorithm and central carrier-assisted technology is realized to effectively improve system performance.

ACPPOEM-0802-5
Experimental Demonstration of Weak Signal Detection Using Photo-Counting Receiver with Inter-Symbol-Interference
Chao Li, Zichen Liu, Zhixue He
Peng Cheng Laboratory, China
We experimentally demonstrate an 10Mb/s OOK weak light signal detection scheme using photo-counting receiver in the presence of inter-symbol interference. BER performance is significantly enhanced from $2e^{-2}$ to $5e^{-5}$ compared with direct detection scheme.

ACPPOEM-0802-8
Noise Equalization of Nonlinear Frequency Division Multiplexing Wavelength Division Multiplexing System Based on Probabilistic Shaping
Yu Zhang[1], Chenglin Bai[2,3,4], Pengfei Li[2], Wanxiang Bi[1], Qi Qi[1], Hengying Xu[1,3,4], Lishan Yang[1,3,4], Yining Zhang[5], Fan Yang[1]
1.School of Physics Science and Information Engineering Liaocheng University, China; 2.School of Physics Science and Information Engineering Liaocheng University, China; 3.Shandong Provincial Key Laboratory of Optical Communication Science and Technology, China; 4.Liaocheng Key Laboratory of Industrial-Internet Research and Application, China; 5.School of Mathematical Sciences Liaocheng University, China
A noise equalization scheme with probabilistic shaping is proposed for ASE noise, processing noise and phase noise in NFDM-WDM systems, highlighting its potential for both superior performance and large transmission capacity in future optical communication.

ACPPOEM-0805-1
2-D Digital Frequency Offset Loading Technique for Discrete Spectrum Modulated Nonlinear Frequency Division Multiplexing System
Donghu Yao[1], Yanfeng Bi[1], Mingjiao Wang[1], Hongbing Gao[1], Hengying Xu[2,3,4], Yining Zhang[5], Chenglin Bai[3,4,6], Lishan Yang[3,4,7], Wanxiang Bi[1]
1.Liaocheng University, China; 2.School of Physics Science and information Engineering Liaocheng University, China; 3.Shandong Provincial Key Laboratory of Optical Communication Science and Technology, China; 4.Liaocheng Key Laboratory of Industrial-Internet Research and Application, China; 5.School of Mathematical Sciences Liaocheng University, China; 6.School of Physics Science and Information Engineering Liaocheng University, China; 7.School of Physics Science and Information Engineering Liaocheng University, China
We propose a two-dimensional digital frequency offset loading (2D-DFOL) technique for discrete spectrum nonlinear frequency division multiplexing (DS-NFDM) system to improve transmission capacity and mitigate amplified spontaneous emission (ASE) noise.

ACPPOEM-0810-7
Ultra-fast Azimuth Rotation Tracking of SOP Evolution Based on Superimposed FrFT Training Sequence
Li Wang[1], Zhi Cheng[1], Jingchuan Wang[1], Changyuan Yu[1], Ming Tang[2], Jing Zhou[1]
1.The Hong Kong Polytechnic University, Hong Kong, China; 2.Huazhong University of Science and Technology, China
Fractional Fourier transform (FrFT) training sequences (TSs) have been proposed to achieve ultra-fast azimuth rotation tracking of state of polarization (SOP) without sacrificing spectrum efficiency.

ACPPOEM-0811-2
Global Power Analyses in Super C band WDM Transmissions System based on Parameter Estimation
Honga Wang
ZTE Corp., China
Broadband optical transmission with super C band is achieved with precise OSNR analyses based on parameter estimation. An OSNR estimation error ≤ 2.2 dB in an end-to-end WDM system consisting of 16 spans is demonstrated.

ACPPOEM-0813-4
Reservoir Computing for Dispersion Compensation in IMDD Transmission
Yixian Dong, Yiqian Shi, Liang Liu, Xihua Zou, Wei Pan, Lianshan Yan
Southwest Jiaotong University, China
The digital reservoir computing for chromatic dispersion compensation is compared with traditional FFE and DFE equalizers in the IMDD transmission system for the first time, showing its more than 1-dB penalty of receiver sensitivity.

ACPPOEM-0814-1
Experimental Demonstration of 520-Mbps LED-Based UWOC Utilizing Nonlinear Weighted DFE
King Shing Lo, Junwei Zhang, Chao Lu
The Hong Kong Polytechnic University, Hong Kong, China
A nonlinear weighted DFE (NWDFE) is introduced and demonstrated in a 520-Mbps PAM-4 blue-LED-based UWOC system for the first time, which improves the data rate by approximately 9% while maintaining similar complexity compared to VFFE-DFE.

ACPPOEM-0814-6
Clustered Cascaded Optical-Electrical Feedforward Equalization for C-band Single-lane 100G ER PAM4 IM/DD Systems
Xiaoqian Huang, Fei Xie, Wen Zuo, Yaojun Qiao
Beijing University of Posts and Telecommunications School of Information and Communication Engineering, China
A low-complexity clustered cascaded optical-electrical feedforward equalization (OE-FFE) scheme is proposed and verified for C-band dispersion-limited high-speed IM/DD PAM4 systems. 7%FEC threshold is achieved for 122Gb/s 40-km PAM4 system with only 35 real-valued multiplications.

ACPPOEM-0814-36
SOA Pre-Amplified 100Gb/s PON Based On Convolutional Neural Networks Nonlinear Digital Pre-Equalization at O-band with 33dB Power Budget
Yuhan Gong, Runzhe Fan, Ming Luo, Chao Yang
State Key Laboratory of Optical Communication Technologies and Networks, China
The experiment achieved 100Gb/s PON using SOA pre-amplified at O-band with 33 dB power budget. The results indicate that the nonlinear pre-equalization based on CNN outperforms than traditional method in optical assess case.

ACPPOEM-0814-43
Single Source Full-duplex Underwater Wireless Optical Communication System based on MEMS Grating Modulator
Lihang Liu[1], Xinke Tang[2], Zhiyan Chen[1], Yibin Li[1], Hongyan Fu[1]
1.Tsinghua University, China; 2.Peng Cheng Laboratory, China
A single source laser-based full-duplex underwater wireless optical communication system using MEMS grating modulator is demonstrated, enabling 200 kbps uplink data rate and 0.5 Gbps downlink data rate simultaneously.

ACPPOEM-0814-47
Coherent Optical Transmitter Impairments Estimation Using Adaptive 2×2 Real-Valued Channel Equalizer
Zepeng Gong[1], Fan Shi[2], Hanyong Wang[2], Yafeng Cheng[2], Desheng Li[2], Ming Luo[1], Xu Zhang[1], Xi Xiao[3], Xiang Li[2]
1.China Information and Communication Technologies Group Corporation, China; 2.China University of Geosciences, China; 3.National Information Optoelectronics Innovation Centre, China
We present a precise estimation method for 60GBaud coherent optical single-carrier systems. The method achieves an absolute estimate error of less than 0.3ps for transmitter skew and 0.1dB for gain imbalance.

ACPPOEM-0815-102
Unequally-Spaced PAM-4 Enabled Power Budget Enhancement of UDWDM-PON Utilizing Simplified Coherent Receiver
Zhou Jiajun[1], Chen Junda[2], Wang Hongli[1], Fu Songnian[3], Tang Ming[2]
1.Hubei Jiufengshan Laboratory, China; 2.Huazhong University of Science and Technology, China; 3.Guangdong University of Technology, China
We numerically investigate a 4×10 Gb/s cost-effective coherent ultra-dense wavelength division multiplexing passive optical network (UDWDM-PON) by the use of unequally-spaced 4-level pulse-amplitude modulation (UES-PAM-4) signal based on gradient descent algorithm. According to the simulation results, a receiver sensitivity of -35.2 dBm for a single wavelength at the bit-error ratio (BER) of 3.8×10^{-3} is obtained. Compared with the conventional equally-spaced PAM-4 (ES-PAM-4) signal, a 2.5 dB receiver sensitivity enhancement can be secured after 20-km standard single-mode fiber (SSMF)

transmission. Meanwhile, the UES-PAM-4 signal is numerically verified for 4×10 Gb/s UDWDM-PON. An average receiver sensitivity of -37.5 dBm and a power budget of 38.5 dB are obtained after the 20-km SSMF transmission. The proposed UES-PAM-4 scheme with the receiver sensitivity enhancement is a promising candidate for the UDWDM-PON in the existing optical distribution network (ODN).

ACPPOEM-0815-38
A Novel Probabilistic Shaping Based Chaotic Encryption for VLC Systems
Jiaqi Chen[1], Yi Sun[1], Yize Zhang[1], Xiaoping Zhang[1,2], Yuhan Dong[1,2]
1.Shenzhen International Graduate School, Tsinghua University, China; 2.Peng Cheng Laboratory, China
Visible light communication (VLC) suffers from eavesdropping due to its broadcast nature and channel openness in public areas. In this paper, we propose a low-rate loss distribution matching to generate shaped symbols, further employing chaotic sequences to encrypt symbols. Numerical results show that the proposed scheme outperforms constant component distribution matching (CCDM)-based probabilistic shaping and conventional direct current-biased optical orthogonal frequency division multiplexing (DCO-OFDM) scheme in terms of both bit error rate (BER) and general mutual information (GMI). The proposed scheme enjoys the benefit of the large key space of 10^{65}, which can prevent almost any violent attacks.

ACPPOEM-0815-40
A study on AM-PM suppression in an optical-RF phase-locked loop
Kunlin Shao, Penghui Gao, Ping Li, Feng Yang, Yamei Zhang, Shilong Pan
Nanjing University of Aeronautics and Astronautics, China
This paper studies the amplitude-to-phase noise (AM-PM) suppression in an optical-RF phase-locked loop. The phase noise induced by AM noise can be suppressed effectively under appropriate condition. More than 80 dB suppression ratio is achieved.

ACPPOEM-0815-48
Fourier Neural Operator Based Modeling of Long-Haul Optical Fiber Channel in Dual-Polarization Systems
Fangfang Huang, Xiatao Huang, Hong Lin, Jing Zhang, Bo Xu, Kun Qiu
University of Electronic Science and Technology of China, China
We present the modeling of fiber channel using Fourier neural operator (FNO). For a 30-GBaud 16-QAM dual-polarization system, the simulation results show that the SNR difference is within 0.15 dB between the FNO and SSFM.

ACPPOEM-0815-59
Underwater Wireless Optical Communication Using Diversity Reception and Pruned-Term-Based Nonlinear DFE
Chao Fei[1], Shu Mao[2], Lusheng Li[2], Feiping Tang[2], Zhenxing Ling[2], Zhaojie Zhang[2], Tianyi Zhang[3], Xiaojian Hong[3], Yuan Wang[3], Jiahan Tian[3], Guowu Zhang[3], Shiyin Li[1]
1.China University of Mining and Technology, China; 2.Ningbo ZSNOW Electronics Co. LTD, China; 3.Zhejiang University, China
Volterra series-based nonlinear equalization is widely used to ease the nonlinearity in underwater wireless optical communication (UWOC) systems. However, the conventional Volterra series-based model is of high complexity, especially for nonlinearity of higher-order terms or longer memory lengths. In this paper, to reduce the complexity of the conventional Volterra series-based nonlinear equalization, a pruned-term based nonlinear decision-feedback equalization (PT-NDFE) is proposed and experimentally demonstrated. Meanwhile, a pruned-term based absolute operation nonlinear decision-feedback equalization (PT-ANDFE) is also introduced to further balance the performance and complexity. The experimental results show that PT-NDFE exhibits comparable performance as compared to conventional NDFE with a lower complexity. While PT-ANDFE yields suboptimal performance with a slight performance degradation but brings further reduced complexity when considering performance and complexity tradeoff. Moreover, diversity reception is employed to further improve performance. The robustness of the proposed schemes in different turbidity waters is experimentally verified. The proposed scheme is promising for cost-effective UWOC systems.

ACPPOEM-0815-61
Real-Time Demonstration of All-Digital Clock Recovery for satellite communication
Yizhou Wang[1], Linsheng Zhong[1], Shenmao Zhang[1], Yuanxiang Wang[1], Jinyang Wu[1], Zhen Luo[1], Xiaoxiao Dai[1,2], Qi Yang[1,2,3], Liu-Deming[1]
1.Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China; 3.Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, China
This paper experimentally demonstrates a real-time digital clock recovery algorithm in a 1.024Gb/s BPSK free space optical transmission. Only 110 real-time DSP resources are needed to correct up to ±150PPM clock errors.

ACPPOEM-0815-65
Turbulent OAM Compensation using CNN for OAM-based FSO Communications
Wuli Hu, Jiaxiong Yang, Long Zhu, Andong Wang
School of Communication and Information Engineering, Chongqing University of Posts and Telecommunications, China
We propose a turbulent orbital angular momentum (OAM) compensation scheme based on convolutional neural network (CNN) for OAM-based free-space optical (FSO) communications. The CNN is trained to extract the atmospheric turbulence's inherent OAM based on the intensity distribution. Under various turbulence strengths (D/r_0 = 1, 2, 4), the received power of the multiplexed OAM channels significantly improves, with an average reduction of 12 dB in mode crosstalk. Our work provides an effective solution for improving the communication performance of OAM-based FSO links.

ACPPOEM-0815-66
Free-space Multi-dimentional Mode Coding with Rotating Gear Beams carrying Orbital Angular Momentum
Yangzong Ao, Wuli Hu, Andong Wang, long Zhu
School of Communication and Information Engineering Chongqing University of Posts and Telecommunications, China
The demand for high-dimensional coding techniques for communication systems is increasing. In this study, Laguerre-Gaussian (LG) beams is used as the basic mode of superposition, and specific parametersp, m0, n0, ϕ are added in each superposition to generate a class of four-dimensional structured beams, which is called Rotating Gear Beams (RGBs). High-dimensional RGBs has a large number of available coding modes, which can effectively improve the resource utilization of existing dimensions, and expand the optical communication capacity, theoretically achieving a maximum coding of up to 1024 bits. We demonstrated the exceptional coding capability of RGBs by transmitting a 64-bit grayscale image. Our work will accelerate the development of future optical communications for higher capacity.

ACPPOEM-0815-67
A Quantitative Investigation on the Impact of Microring Modulator Coupling States to 112 Gbps PAM4 Signal Transmission
Junxiong Tan[1,2], Kejia Zhu[1,2], Weiyi Meng[1,2], Qian Wang[1,2], Yu Sun[1,2], Junde Lu[1,2], yueqin Li[1,2], Jian Sun[1,2], min Miao[1,2], Jun Qin[1,2]
1.Key Laboratory of Information and Communication Systems, Ministry of Information Industry, China; 2.Key Laboratory of the Ministry of Education for Optoelectronic Measurement Technology and Instrument, China
In this paper, a comprehensive quantitative analysis on the impact of silicon microring modulators (Si-MRM) coupling states to 112 Gbps PAM4 transmission system based on a system-level model of Si-MRM is demonstrated.

ACPPOEM-0815-70
Free-space optical communication with bottle vortex beam under atmospheric turbulence and finite receiving aperture
Jiaxiong Yang, Wuli Hu, Andong Wang, Long Zhu
Chongqing University of Posts and Telecommunications, China
To enhance the performance of orbital angular momentum (OAM) beams in Free-Space Optical (FSO) communications under conditions of atmospheric turbulence and finite receiving aperture, we propose a design for parabolic trajectory Bottle vortex beams (BVBs) using the caustic line method. Compared to conventional OAM beams, BVBs exhibit a smaller beam diameter at the receiver while displaying enhanced resistance to turbulence. Under conditions of strong turbulence D/r_0 = 4 and a receiver aperture of 20 mm, the average received optical power of BVBs is increased by 12 dBm and 40 dBm compared to OAM beams, respectively.

ACPPOEM-0815-71
FPGA Implementation of 5-bit Non-Uniform Quantization LDPC Code for High-speed PON
Zipeng Liang[1], Tian Qiu[1], Yang Zou[1], Yizhou Wang[1], Ningchang Zhangsun[1], DaiXiaoxiao[1,2], YangQi[1,2,3], Deming Liu[1]
1.Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China; 3.Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information Huazhong University of Science and Technology, China
This paper proposes and verifies a resource-efficient 5-bit non-uniform quantization LDPC code for LLR processing. This low power consumption and low latency LDPC decoding method is promising for future high-speed PON.

ACPPOEM-0815-109
SDM solution for datacenters based on weakly-coupled multi-core fiber
Jun Chu[1,2], Lei Shen[1,2,3], Shuo Xu[1,2], Xianchao Gong[1,2], Liubo Yang[1,2], Ying Li[1,2], Xinhua Fu[1,2], Li Zhang[1,2], Lei Zhang[1,2,3], Jie Luo[1,2,3]
1.State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China; 2.Yangtze Optical Fibre and Cable Joint Stock Limited Company, China; 3.Optical valley labs, China
We report a SDM solution for datacenters based on weakly-coupled multi-core fiber. The solution is consisted of design, fabrication and measurement of 4-core single mode fiber, fan in/out device, and LC/MPO connectors. This MCF solution can be used in the optical interconnects for short reach applications that allows to multiply the capacity.

ACPPOEM-0816-1
Fast Computational Algorithm for the Weakly Coupled FMF Model
Zhengyang Li[1], Yangan Zhang[1], Xueguang Yuan[1], Peiren Wang[2], Yongqing Huang[1]
1.Beijing University of Posts and Telecommunicatios, China; 2.Tianjin Research Institute for Water Transport Engineering, M.O.T., China
The transmission of optical waves within Few-Mode Fiber (FMF) is challenged by the influences of dispersion, attenuation, various nonlinear effects, and inter-modal crosstalk arising from suboptimal transmission conditions. Therefore, this paper introduces a fast computation algorithm for the weakly coupled FMF model. Building upon the split-step Fourier algorithm, this method subdivides the computation step size into smaller intervals, each computed independently using parallel algorithms. Additionally, the inter-modal crosstalk terms are represented as matrix-vector multiplications and accelerated using matrix libraries. Experimental verification demonstrates a 37% efficiency improvement compared to the split-step Fourier algorithm.

ACPPOEM-0816-4
Application of Full-Nyquist Pulse on Hybrid SSB OFDM-Digital Filter Multiple Access PONs
Liang Liu, Yixian Dong, Yiqian Shi, Xihua Zou, Wei Pan, Lianshan Yan
Southwest Jiaotong University, China
Full-Nyquist-pulses are utilized in Hybrid SSB OFDM-digital filter multiple access PON for the first time. Compared to square-root-raised-cosine filter, they have higher receiver sensitivity and more robustness to system ISI/noise.

Track 3: Network Architectures, Management and Applications

ACPPOEM-0702-1
Dynamic Hybrid Single-Multi-Path RSA Algorithm in Semi-Filterless Optical Networks
Yanyan Xie[1], Junling Yuan[1], Xuhong Li[2], Qikun Zhang[1], Suhua Wang[1]
1.Zhengzhou University of Light Industry, China; 2.Zhongyuan University of Technology, China
This paper proposes a dynamic hybrid single-multi-path (DH-SM) RSA algorithm. Simulation results show that the proposed algorithm has a lower blocking rate than those using fixed bandwidth assignment granularity and traditional single-path algorithms.

ACPPOEM-0721-3
Industrial PON Application Innovation Pilot based on 50G-PON and XG-PON Hybrid Architecture
Jialiang Jin[1], Dezhi Zhang[1], Ming Jiang[1], Dekun Liu[2], Hui Sun[1], Ziyao Yang[1], Tao Zeng[1], Heng Yue[1], Xiao Yu[1], Feng Zhu[1]
1.China Telecom Research Institute, China; 2.Huawei Technologies Co., China
Requirements of industrial applications, and the architecture and key capabilities of 50G-PON are introduced. In this pilot project, the mixed application of 50G-PON and 10G-PON provides ultra-high bandwidth, stable and reliable, and flexible access capabilities.

ACPPOEM-0721-6
Dynamic routing, spatial channel and spectrum assignment (RSCSA) in spatial channel networks (SCNs)
Yu Zheng[1], Weichang Zheng[2], Mingcong Yang[3], Yongbing Zhang[1]
1.University of Tsukuba, Japan; 2.University of Electronic Science and Technology of China, China; 3.Huawei Technologies, China
In this paper, we propose a dynamic RSCSA algorithm that employs a granularity switching threshold to efficiently switch between spatially bypassed and spectrally groomed space lanes depending on the request demand in spatial channel networks (SCNs).

ACPPOEM-0728-20
GPU-efficient Deployment of Ring All-Reduce-based Distributed Model Training in Tidal Computing Power Network
Yingbo Fan, Yajie Li, Ling Chen, Boxin Zhang, Yahui Wang, Jiaxing Guo, Wei Wang, Yongli Zhao, Jie Zhang
Beijing University of Posts and Telecommunications, China
This paper proposes a tidal-aware deployment algorithm for RAR-based DMT services in tidal CPN. The algorithm performance is evaluated in resource sufficient and constrained cases, respectively. Simulation results verify the benefit of reducing 20.6% GPU United Statesge by dynamically partitioning training data and allocating GPU resources.

ACPPOEM-0730-7
A Load Balancing and Time-Frequency Fragmentation-aware Algorithm for Elastic Optical Network
Mingxuan Yu[1], Jing Jiang[1], Tao Shang[1], Junfeng Zhai[1], Haotian Liang[1], Makoto Tsubokawa[2]
1.School of Telecommunications Engineering, Xidian University, China; 2.Graduate School of Information, Production and System, Waseda University, Japan
In order to improve the performance of EONs, spectrum management is necessary. In this paper, a Load Balancing and Time-Frequency (LB-TF) fragmentation awareness algorithm is proposed.

ACPPOEM-0730-42
Routing and Spectrum Assignment in Spatial Channel Network-based Inter-Datacenter Networks
Zheng Weichang[1], Zheng Yu[2], Yang Mingcong[3], Yang Kun[4]
1.School of Information and Communication Engineering,Yangtze Delta Region Institute, University of Electronic Science and Technology of China, China; 2.Graduate School of Systems and Information Engineering, University of Tsukuba, Japan; 3.Department of R&D, Huawei Technologies, China; 4.School of Information and Communication Engineering, University of Electronic Science and Technology of China, China
We introduce spatial channel networks (SCNs) to the interconnection of data center networks (DCNs). We propose an integer linear programming (ILP) model to solve the routing and spectrum assignment problem for SCN-based inter-DCNs.

ACPPOEM-0731-20
Delay-Energy-Aware Dependent Task Offloading Based on Orchard Algorithm in Collaborative Cloud-Edge Optical Networks
Shuyao Wang, Shan Yin, Shanguo Huang
Beijing University of Posts and Telecommunications, China
We study the problem of dependent task offloading in cloud-edge scenario interconnected by optical networks. An effective orchard algorithm-based dependent task offloading method is proposed to jointly optimize the delay and energy consumption.

ACPPOEM-0731-68
Computing Power Slicing Strategy Based on Deep Reinforcement Learning Under the Constraint of Services Intention
Zhengjie Sun[1], Hui Yang[1], Qiuyan Yao[1], Jie Zhang[1], Sheng Liu[2], Dong Wang[2]
1.Beijing University of Posts and Telecommunications, China; 2.China Mobile Research Institute Department of Fundamental Network Technology, China
In order to fully exploit the advantages of computing power optical networks, we propose a computing power slicing strategy based on Deep Reinforcement Learning under the constraint of services intention. The simulation results show that this scheme performs best in terms of average delay and overall network blocking probability.

ACPPOEM-0731-87
Joint Resources Allocation for Asynchronous Distributed Training in Cloud-edge Collaborative Optical Networks
Xiaodong Liu, Yutong Chai, Zheng Duan, Zhidong Zhang, Shan Yin, Shanguo Huang
State Key Laboratory of Information Photonics and Optical Communications, China
We analyze the asynchronous model parallel training process in the cloud-edge collaborative scenario and propose pipeline optimization scheme considering communication delay. Based on scheme, we propose a multi-task optimization algorithm named Resourc Aware Balance Allocation.

ACPPOEM-0731-98
Adaptive Cross-Layer Bandwidth Defragmentation for Multi-band Optical Network
Liu Jiaxin, Xi Ziyi, Gu Rentao
Beijing University of Post and Telecommunications, China
We propose an adaptive IP/optical cross-layer bandwidth defragmentation algorithm to reduce bandwidth fragmentation caused by the mismatch between services and channels in multi-band optical networks. Experimental results demonstrate that the bandwidth utilization improves significantly.

ACPPOEM-0731-145
Mixed Channel Traffic Grooming in an SBPP-Based IP over MCF-EON with Minimized Inter-core Crosstalk
Fengxian Tang[1], Gangxiang Shen[2]
1.Shenzhen Polytechnic Univeristy, China; 2.Soochow University, China
Traffic grooming and shared backup path protection (SBPP) can significantly improve network resource utilization and ensure the survivability in multi-core fiber-elastic optical networks (MCF-EON). However, addressing routing, core, modulation, and spectrum assignment (RCMSA) with the consideration of inter-core crosstalk in such networks is challenging. In this paper, we propose an efficient auxiliary graph (AG) based algorithm to tackle this challenge in the context of an IP over MCF-EON. Our results demonstrate significant improvement in networkresource utilizationand reduction in inter-core crosstalk, thereby confirming the effectiveness of the proposed approach.

ACPPOEM-0731-155
Reconfigurable Topology Design with Deep Reinforcement Learning in Satellite Optical Network
Yun Xiao[1,2], Bingli Guo[1,2], Hai Yang[1,2], Kuan Yan[1,2], Shanguo Huang[1,2]
1.State Key Lab of Information Photonics and Optical Communication, China; 2.Beijing University of Posts and Telecommunications, China
To minimize delay of satellite optical network, this paper proposes an enhanced deep deterministic policy gradient scheme for reconfigurable topology design with distinct traffic intensity. Simulation results show that average delay is reduced about 28%.

ACPPOEM-0731-177
Research on Routing and Spectrum Allocation Algorithm in C+L Band Elastic Optical Networks
Lingfei Shen[1], Nan Feng[2], Yunxuan Liu[1], Dan Yan[1], Shihao Fan[1], Danping Ren[1], Jijun Zhao[1]
1.Hebei University of Engineering, China; 2.54 Institute of China Electronic Technology Corporation, China
In C+L band EONs, we propose a routing and spectrum allocation algorithm that consider both spectrum resource and link transmission distance. Simulation results demonstrate the proposed algorithm effectively decreases blocking probability and improves resource utilization.

ACPPOEM-0801-9
Cost-effective computing power provisioning for video stream in Computing Power Network with mixed CPU&GPU
Yahui Wang, Yajie Li, Jiaxing Guo, Yingbo Fan, Ling Chen, Boxin Zhang, Wei Wang, Yongli Zhao, Jie Zhang
Beijing University of Posts and Telecommunications, China
We propose the concept of RVC to quantify the United Statesge efficiency of CPU and GPU in CPN. A RVC-based computing provisioning algorithm is then designed for processing video stream services. The algorithm can accommodate more services by reducing 4.2% blocking probability through cost-effective computing provisioning.

ACPPOEM-0801-41
Availability-Aware Dedicated Path Protection Schemes for Key Service in Quantum-Key-Distribution Optical Networks
He Bin[1], Lu Yuxuan[1], Chen Hong[1], Shao Weidong[1], Jiang Min[1], Zhou Liulei[1], Chen Bowen[1], Ju Weiguo[2]
1.School of Electronic and Information Engineering, Soochow University, China; 2.Institute of ICT Technology, China Information Consulting&Designing Institute CO., LTD, China
Two availability-aware dedicated path protection schemes for key service are proposed in quantum-key-distribution optical network. Simulation results show that the proposed schemes performs well in terms of success ratio, timeslot occupancy, and average unavailability of key services.

ACPPOEM-0801-45
Inter-core Crosstalk Aware Deep Reinforcement Learning Based Resource Allocation in Multicore Elastic Optical Networks
ChengHao Li, Yue-Cai Huang, Liwei Mu
South China Normal University, China
We present a deep reinforcement learning (DRL) framework for the routing, modulation, core selection, and spectrum allocation (RMCSA) of the multicore elastic optical networks. Specifically, the DRL agent senses the impact of the inter-core crosstalk and makes the RMCSA decisions accordingly.

ACPPOEM-0801-52
Data-Aware Hierarchical Task Offloading in Collaborative Cloud-Edge Elastic Optical Networks
Yuexuan Fan, Weiguo Ju, Jian Dang, Huijie Yang, Liulei Zhou, Hong Chen, Weidong Shao, Bowen Chen
Soochow University, China
We proposed data-aware hierarchical task offloading method to optimize network resource allocation. Compared to existing methods, simulation results show the proposed methods can reduce end-to-end latency andblocking probability in collaborative cloud-edge elastic optical networks.

ACPPOEM-0801-58
Cross-domain Resource Scheduling of Computing Service Based on Particle Swarm Optimization
Yang Zhao[1], Yunyu Zhang[2], Hui Yang[2], Tiankuo Yu[2], Yucong Liu[1], Yunbo Li[1]
1.China Mobile Communication Corporation Research Institute, China; 2.StateKey Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China
In this paper, we propose a cross-domain delay optimization scheme to optimize the delay in the metro, regional, and backbone domains respectively. The simulation results show that, compared with the benchmark, this scheme can effectively reduce the blocking rate, basically meet the delay upper limit of each domain, and finally construct threedelay circles.

ACPPOEM-0801-63
Three Gossiping Protocols in Three-Dimensional Underwater Optical Cellular Network
Yuan Wang[1], Tianyi Zhang[1], Jiahan Tian[1], Junwei Zhang[2], Yitong Xie[1], Fei Zhang[1], Guowu Zhang[1], Gaoxuan Wang[1], Xiaojian Hong[1], Chao Fei[1], Sailing He[1]
1.Zhejiang University, China; 2.The Hong Kong Polytechnic University, Hong Kong, China
In this paper, three different low-complexity sector-based Gossiping routing protocols, namely Gossiping with probabilistic selection (Gossiping-PS), Gossiping with visibility priority (Gossiping-VP), and Gossiping with energy priority (Gossiping-EP), are evaluated through the three-dimensional underwater optical cellular network (UOCN). Comprehensive performance comparisons are made among the above three routing protocols in terms of the average hop, end-to-end delay, network lifetime, packet-loss rate, and energy utilization. Numerical analysis shows that Gossiping-PS significantly outperforms the other two schemes, while Gossiping-VP and Gossiping-EP behave even worse than the standard Gossiping routing protocol under some circumstances, which is owing to the fact that the Greedy algorithm makes the best choice for the current moment instead of taking the global optimality into consideration.

ACPPOEM-0801-86
An Layered Topological Scheduling Method for Cutover in Optical Networks
Xin Qin, Tongquan An, Qian Hu, Fan Yang, Xia Gao, Guangnan Su
China Telecom, China
The intelligent scheduling method is proposed for cutover by converting tasks and rules into a layered topological graph. The experiment in real optical networks demonstrates that our method can achieve a conflict-free and effective schedule.

ACPPOEM-0801-119
Multi-dimensional Data Collection for High-performance Optical Transport Network Maintenance and Optimization
Yu Tang[1,2,3], Xiongyan Tang[1], Yakun Hu[1], Shikui Shen[1], Yan Shi[1], Chuanbiao Zhang[1], He Zhang[1], Zhiguo Zhang[3]
1.China Unicom Research Institute, China; 2.China United Network Communications Group Corporation Limited, China; 3.Beijing University of Posts and Telecommunications, China
In this work, weinvestigated optical power, OSNR and fiber length collected by the MCSof a 400G C+L system and compared with the results measured by separate measurement equipment.

ACPPOEM-0811-11
Toward Increasing User Capacity through Application of Loopback-enabled Architecture and an Adaptive Caching Strategy in Mobile Cellular Networks
Cheng Jin, Yongbing Zhang
University of Tsukuba, Japan
In this paper, we adopt a loopback-based passive optical network architecture in the mobile cellular network and formulate a data caching problem adapting the loopback-enabled network structure for optimal number of served users in the network. We also propose a heuristic caching algorithm adapting the proposed network structure to increase the number of served users and address the issue of time-inefficiency with obtaining optimal values. The simulation results show that there was less than 5% of difference between numbers of served users obtained using proposed algorithm and optimal values, whilst the calculation time for proposed algorithm was significantly reduced compared to optimizations. Furthermore, the number of served users by using our proposed method can be 15% higher than previous studies.

ACPPOEM-0814-41
Strategies of Switching Granularity Selection for Lightpath Services in a Multi-Granularity Optical Network
Zhilin Yuan[1], Huitao Zhou[2], Yongcheng Li[1], Jiawei Zhang[2], Gangxiang Shen[1]
1.Soochow University, China; 2.Beijing University of Posts and Telecommunications, China
We address the issue of selecting switching granularity in a multi-granularity optical network (MGON), focusing on sub-wavelength, wavelength, and waveband granularities. We propose three strategies for granularity selection: network performance prioritization (NPP), service quality prioritization (SQP), and a balanced approach considering both network performance and service quality (BNPSQ). Through simulations, we find that the BNPSQ strategy effectively improves overall network performance and average task completion time (TCT), while fulfilling all the service requirements.

ACPPOEM-0814-45
Assessment of Machine-Learning-based Traffic Prediction Algorithms for Real Access/Metro Network Traffic
Zhewei Lei[1], Fu Wang[1], Leijing Yang[1], Qinghua Tian[1], Li Li[2], Xiongyan Tang[2], Qi Zhang[1], Dandan Sun[1]
1.Beijing University of Posts and Telecommunications, China; 2.China Unicom, China
In this paper, a Graph-Convolutional-Network-Transformer traffic prediction method is proposed and assessed in real network traffic scenarios. An accuracy of 99.47% is achieved, which is better than existing algorithms.

ACPPOEM-0814-68
A Protection Method Based On Shared Slice With Multidimensional Resource In Optical Networks
Shuang Ma, Meng Lian, Xin Li, Yunxiao Ning, Yongli Zhao
Beijing University of Posts and Telecommunications, China
This study proposes a protection method based on shared slice with multidimensional resource to solve the resource waste problem caused by ensuring optical network survivability. Simulation results demonstrate that the proposed algorithm can decrease the service blocking rate and enhance the utilization rate of network resources compared to benchmark algorithms.

ACPPOEM-0815-5
Efficient Redundant Transmission Assurance Mechanisms in the Control Plane for Low-Earth-Orbit Satellite Optical Networks
Wenkui Guo[1], Fu Wang[1], Weiying Feng[2], Qi Zhang[1], Tao Dong[3], Jie Yin[3], Zhewei Lei[1]
1.Beijing University of Posts and Telecommunications, China; 2.Beihang University, China; 3.Space Star Technology Co., Ltd, China
We propose a parallel forwarding redundancy protection algorithm for the control plane of LEO satellite networks based on regional centralized management to reduce flooding operations, and improve system efficiency.

ACPPOEM-0815-16
Multi Hierarchy Mapping Based Computing Power Scheduling for Data Center Optical Network
Wenxin Liu, Hui Yang, Tiankuo Yu, Qiuyan Yao, Ao Yu, Jie Zhang
Beijing University of Posts and Telecommunications, China
This paper introduces a scheduling method of computing power of data center optical network based on multi-hierarchymapping, which aims to solve the challenge of computing power of heterogeneous devices that can not be measured uniformly and realize the balanced allocation of residual computing power resources between different hardware devices. Experimental results show that this method can significantly reduce the total delay of data center optical network, and improve the service processing efficiency by about 50%.

ACPPOEM-0815-58
Timeslot-Aware Protection Scheme with Dynamic Request Adjustment in QKD Optical Networks
Yuxuan Lu[1], Bin He[1], Hong Chen[1], Weidong Shao[1], Ming Jiang[1], Liulei Zhou[1], Bowen Chen[1], Weiguo Ju[2]
1.Soochow University, China; 2.Consulting & Designing Institute CO., LTD, China
In this paper, we proposed a timeslot-aware protection scheme with dynamic request adjustment (TAPS-DRA) to enhance timeslot utilization and success probability within quantum key distribution (QKD) optical networks. Simulation results show that the proposed TAPS-DRA can achieve higher success probability of requests and greater security requirement adaptability.

ACPPOEM-0815-75
QoT Assured RBMSA Design for Shared Path Protection based C+L Bands EONs
Yunxuan Liu[1], Nan Feng[2], Lingfei Shen[1], Jingjing Lv[1], Jinhua Hu[1], Jijun Zhao[1]
1.Hebei University of Engineering, China; 2.54 Institute of China Electronic Technology Corporation, China
This paper proposes a robust RBMSA algorithm for survivable C+L bands EONs to guarantee the OSNR of working paths and backup paths.

ACPPOEM-0815-89
A Hybrid Heuristic Algorithm for Disaster Backup in Data Center Networks
Lin He, Jiayuan Hu, Fengchao Fu, Min Gao, Hao Liu, Weihua Cao
China Telecom Research Institute, China
We propose a hybrid heuristic algorithm that combines particle swarm optimization and ant colony optimizationalgorithm, which enables efficiently selecting transimission paths for rapid disaster backup in data center networks.

ACPPOEM-0815-94
Fast configuration planning algorithm for cost optimization in undersea fiber cable system
Haoyu Wang
School of Electronic Engineering, Beijing University of Posts and Telecommunications, China
We propose and numerically study a fast configuration planning algorithm for cost optimization in undersea fiber cable system Compared with full traversal algorithm, it has been accelerated by 30 times.

ACPPOEM-0815-105
Meta Learning based QoT Estimation of lightpaths with few samples for Optical Networks
Shangbo Lin, Zhiqun Gu, Yuefeng Ji, Jiawei Zhang
State Key Lab of Information Photonics and Optical Communications, BUPT, China
We propose a meta learning based QoT estimation method to estimate the quality of transmission of lightpaths with few samples. The simulation results demonstrate that the proposed method outperforms the traditional models and save train-

ing samples significantly.

Track 4: Optoelectronic Devices and Integration

ACPPOEM-0701-1
Temperature dependence characteristics and noise characteristics of InGaAs/InAlAs X-ray APDs
Yanli Zhao, Wenqiang Ding
Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, China
The temperature dependence characteristics and noise characteristics of InGaAs/InAlAs X-ray avalanche photodiodes (APDs) with different structures have been investigated. Homemade devices have a lower temperature coefficient(16.20 mV/K) and noise than commercial InGaAs/InPAPDs.

ACPPOEM-0706-1
Research on novel coplanar waveguide electrodes for enhancing the bandwidth of photodiodes
Tonghui Li, Yu Li, Xiaole Gong, Xiaofeng Duan, Kai Liu, Yongqing Huang
Beijing University of Posts and Telecommunications, China
This paper presents a novel photodiode electrode structure to enhance the bandwidth of photodiodes. Simulation results demonstrate that the bandwidth of the photodiode using the proposed electrode can increase by over 40%.

ACPPOEM-0714-1
Design and Performance of High-speed InGaAs/InGa$_{0.351}$As$_{0.755}$P Modified-pin Photodiodes
Yu Li, Tonghui Li, Xiaole Gong, Kai Liu, Yongqing Huang, Xiaofeng Duan
Beijing University of Posts and Telecommunications, China
A high-speed InGaAs/InGa$_{0.351}$As$_{0.755}$P modified-pin photodiode (M-PIN-PD) is presented and investigated. The 3-dB bandwidth of the M-PIN-PD with an absorber layer thickness of 800 nm is 48 GHz and a responsivity of 0.78 A/W.

ACPPOEM-0719-7
High-efficient Silicon Microring Modulator of 3D Omni-junction Profile
Zijian Zhu[1,2], Yingxuan Zhao[1], Fuwan Gan[1,2]
1.Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China; 2.University of Chinese Academy of Sciences, China
A silicon microring modulator composed of U-shaped and L-shaped junctions is demonstrated with the VπL of 0.78 V·cm and bandwidth over 28.1 GHz. Results demonstrate the feasibility of complex 3D doping profiles for high-speed applications.

ACPPOEM-0721-10
High-power 1.5 μm InGaAsP/InP BH laser having dilute waveguide structure
Guo Jing[1,2,3], Li Huan[1,2,3], Zhao Lingjuan[1,2,3], Zhou Daibing[1,2,3], Liang Song[1,2,3]
1.Key Laboratory of Semiconductor Materials Science, Institute of Semiconductors, Chinese Academy of Sciences, China; 2.Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, China; 3.Beijing Key Laboratory of Low Dimensional Semiconductor Materials and Devices, China
A 1.5μm high power buried heterojunction (BH) semiconductor laser having dilute waveguide structure has been fabricated. At room temperature, the peak output power is 132 mW. The vertical and lateral divergence angles are 16.8×32.4 degree.

ACPPOEM-0725-8
Optical Phase-Locked Loop Based on a Hybrid Integrated Self-Injection Locked Laser
Minghua Chen[1,2], Shuai Shao[1,2], Liwei Tang[1,2]
1.Beijing National Research Center for Information Science and Technology, China; 2.Department of Electronic Engineering, Tsinghua University, China
We propose an optical phase-looked loop (OPLL) based on an integrated self-injection locked laser. By tuning the high-Q microring resonator (MRR) external cavity, the hybrid slave laser can achieve high-precision phase-locking with the master laser.

ACPPOEM-0726-3
Polarization-insensitive four-channel wavelength-division (de)multiplexer based on cascaded Mach-Zehnder interferometers with adiabatic couplers
Huan Guan
Institute of Semiconductors , Chinese Academy of Sciences, China
A polarization-insensitive 4-channel wavelength (de)multiplexer based on MZIs and adiabatic couplers is proposed. Simulation show that it has a 3-dB bandwidth of 3.21 nm, and the polarization dependent losses are 0.0057 dB for four channels.

ACPPOEM-0726-10
50 Gb/s Wavelength Tunable DBR Laser Integrated with an Electro-absorption Modulator
MengYang Zhong[1], Huan Li[2], Dan Lu[2], LingJuan Zhao[2], Song Liang[2], Kun Yang[1], DaiBing Zhou[2]
1.Zhengzhou University of Light Industry, China; 2.Institute of Semiconductors, Chinese Academy of Sciences, China
A wavelength tunable DBR laser integrated with an electro-absorption modulator TEML operating in the 1.5 μm band was prepared using an InGaAlAs/InP quantum well structure. At 40 °C, the small signal bandwidth of TEML laser was greater than 28 GHz, and the wavelength tuning range was 12.4 nm. 50 Gb/s data transmission is implemented over the entire wavelength tuning range.

ACPPOEM-0726-13
Hybrid-core planar waveguide mode multiplexer fabricated by multi-step photolithography for high-order-mode-passed guide mode manipulating
Quandong Huang, Jiali Zhang, Zhaoqiang Zheng, Jianping Li, Ou Xu, Yuwen Qin
Guangdong University of Technology, China
We propose a methodology to realize the fabrication of hybrid-core planar waveguide mode multiplexer by using multi-step photolithography and demonstrate in the experiment for manipulating the fundamental mode without affecting the high-order modes.

ACPPOEM-0726-14
Power-efficient, ultra-broadband and reconfigurable four-mode converter
Shijie Sun, Yuanhua Che, Tianhang Lian, Daming Zhang, Xibin Wang
Jilin University, China
A power-efficient, ultra-broadband and reconfigurable four-mode converter is designed based on two 1×4 Y-junctions assisted by four thermo-optic phase shifters. The device can realize arbitrarily conversion between four modes with power-consumption of ~ 6.2 mW.

ACPPOEM-0726-21
Image encoding and recovery based on inhibited spiking dynamics of VCSEL neuron
Zhifei Duan, Xiaodong Lin, Yingke Xie, Xiaorui Du, Xue Wu, Lin Ma, Zhengmao Wu, Tao Deng
Southwest University, China
We propose and numerically investigate an image encoding and recovery system based on the inhibited spiking dynamics of a 1550-nm vertical-cavity surface-emitting laser (VCSEL) neuron. The results demonstrate that VCSELs subject to orthogonal optical injection can mimic the behaviors of biological neurons under external perturbations (stimuli) with different intensities and durations. Furthermore, VCSEL neuron can possess the encoding capability of binary-to-spike with GHz rate. Based on the post-processing techniques of spiking dynamics, the image recovery with bit error rate (BER) of 6.6×10^{-3} is achieved.

ACPPOEM-0727-7
A Low-Loss Polarization-Splitting Grating Coupler based on Inverse-Design
Lan Wu, Jifang Qiu, Lihang Wang, Yuchen Chen, Hongxiang Guo, Jian Wu
Beijing University of Posts and Telecommunications, China
We present a vertical polarization-splitting grating coupler (PSGC) designed using inverse design method. The insertion loss of this PSGC is minimized to -1.52 dB and -1.62 dB at 1555 nm for two polarizations.

ACPPOEM-0727-8
Optimization design of arrayed waveguide grating using dual-etched multimode interference aperture
Xudong Du, Yu Cheng, Tao Shi, Jinhua Chen, Chen Ji
Zhejiang University, China
We propose a low-loss and wide-bandwidth 4-channel SOI horseshoe-shaped MMI-AWG based on dual-etched waveguide apertures. The 3dB bandwidth of the device has been improved from 0.9nm to 3.1nm, with an insertion loss below 5.5dB.

ACPPOEM-0728-2
Silicon Photonic Filter using an Elliptical Micro-Ring with Small Bent Radius and Ultra-Large FSR
Xu Hua Cao[1,2,3], Yu Hao Zhang[1,2,3], Ming Li[1,2,3], Ning Hua Zhu[1,2,3], Wei Li[1,2,3]
1.State Key Laboratory on Integrated Optoelectronics, Institute of Semiconductors, Chinese Academy of Sciences, China; 2.School of Electronic, Electrical and Communication Engineering, University of Chinese Academy of Sciences, China; 3.Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, China
We propose a silicon photonic filter using an elliptical micro-ring, and describe in detail of the simulation studies conducted on minimizing the bent radius and maximizing the free spectral range (FSR). The ultra-large FSR of 56 nm is realized without multimode involved in the filter.

ACPPOEM-0728-9
A 56 Gb/s 9.6 mW PAM-4 Receiver Analog Front end based on gm-boosted
Shunyu Li[1], Guang Yong Chu[1,2], Pengfei Niu[3], Velásquez Micolta Juan Camilo[4], Shixun Zhang[5], Guofeng Yang[1]
1.Jiangnan University, China; 2.Jiangsu Provincial Research Center of Light Industrial Opto. Engi.&Tech, China; 3.Tianjin University, China; 4.Universidad Autónoma de Manizales, Colombia; 5.Peng Cheng Laboratory, China
The analog front-end receiver provides a data rate of 56 Gb/s while using only 9.2 mW power. It adjusts for 27.1 dB loss to maintain a bit error rate under 10^{-9} , and its FoM of 0.006 pJ/bit/dB greatly improves energy efficiency.

ACPPOEM-0728-16
Ultralow-Loss Power Splitters Based on Shape Optimization Method
Yijun He, Jifang Qiu, Bowen Zhang, Suping Jiao, Hongxiang Guo, Jian Wu
State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China
We demonstrate two 1 × 4 MMI power splitters by using a shape optimization method. Simulation results show that uniform power splitting and a splitting ratio of 1:2:4:8 are both realized with ultra-low insertion loss.

ACPPOEM-0728-19
800 Gbps Integrated Silicon Photonics Receiver Chip Based on Cascaded Mach-Zehnder Interferometer (MZI) Lattice Filters
Ruiqi Luo[1], Maojing Hou[1], Wei Ma[1,2]
1.Zhejiang Laboratory, China; 2.Zhejiang University, China
We have successfully demonstrated an integrated polarization-diversified 8×100 Gbps Silicon Photonics Receiver chip, which is composed of an edge coupler, a polarization splitter-rotator, two cascaded Mach-Zehnder Interferometer (MZI) lattice filters, and high-speed germanium photodetector (GeSi PD) array. We tested the bandwidth of the GeSi detector (> 40GHz) and measured the eye diagram of the receiver chip with 53.125Gbaud PAM4 signal for each channel.

ACPPOEM-0728-35
Programmable high-precision weight bank based on integrated semiconductor optical amplifier array
Jiahui Liu[1,2], Kaifei Tang[1,2], Xiang Ji[1,2], Xin Zhou[1,2], Chuanbo Zhang[1,2], Ling Wang[1,2], Wentao Sun[1,2], Pan Dai[1,2], Shaobo Li[3], Xiang Ma[3], Rulei Xiao[1,2], Xiangfei Chen[1,2]
1.College of Engineering and Applied Sciences, Nanjing University, China; 2.National Laboratory of Solid-State Microstructures, Nanjing University, China; 3.Optical Communication Research and Development Center, the 54th Research Institute of China Electronics Technology Group Corporation, China
As the main challenge for in-memory photonic computing, high-precision weight controlling will enable us to perform parallel multiply accumulate (MAC) with enhanced computing accuracy. Considering environmental factors such as fluctuation of temperature, it's difficult to accurately control the weight for photonic computing. To solve the problem above, we proposed an integrated array of semiconductor optical amplifiers (SOAs) as photonic synapses for programmable weight bank. A monolithically integrated 8-channel DFB-SOA chip is designed and fabricated, demonstrated record-high precision of 9.2 bits for weighting control.

ACPPOEM-0729-14
Optical Nonlinearity Enhancement in Silicon Nitride Organic Hybrid Strip Waveguide
Wentao Ye, Lei Lei
Shenzhen University, China
We demonstrate a dispersion-engineered nonlinear Si_3N_4 waveguide. The conversion efficiency of the four-wave mixing exhibits great enhancements of more than 13 dB and 17 dB compared to Si_3N_4 waveguide and silicon-organic hybrid slot waveguide, respectively.

ACPPOEM-0730-3
2×2 SOI optical switch with robust high extinction ratio on all paths enabled by parabolic MMI coupler
Guihan Wu, Haijiang Cao, Minfeng Jin, Xin Zhou, Qiuyang Jiang, Wei Jiang
Nanjing University, China
We propose and experimentally demonstrate a Mach-Zehnder silicon thermo-optic switch based on a parabolic multimode interference coupler. By judiciously designing the parabolic structure, the 2×2 MMI can exhibit an extremely small imbalance of output power around 0.1 dB over the C band and have good manufacturing tolerances according to simulation. As such, for all four possible switching paths, high average extinction ratios over 35 dB can be achieved from 1520 nm to 1580 nm in the experiment, with maximum values concurrently over 40 dB. The proposed parabolic MMI occupies a small area of merely 2.4 μm × 9.5 μm.

ACPPOEM-0730-5
Ultra-wide and ultra-compact spot size converter based on dielectric metasurfaces
Desheng Zeng, Qingzhong Huang
Wuhan National Laboratory for Optoelectronics, China
We present a compact and efficient spot size converter (SSC) design method based on metasurfaces, which is suitable for beam transformation between single mode waveguide and any wide multi-mode waveguide in theory. Two kinds of SSCs connecting 100 μm or 12 μm wide waveguide with 0.5 μm wide waveguide have been fabricated. Experiments show that the insertion losses are 0.81 dB and 1.00 dB at 1550nm, respectively. For SSCs connecting 100 μm or 12 μm wide waveguide with 0.5 μm wide waveguide, the insertion losses are both lower than 1.50 dB in 1530-1580 nm and 1500-1590 nm, respectively.

ACPPOEM-0730-20
A high-power modified uni-traveling-carrier photodiode (MUTC-PD) operating at 1310nm band for Radio-over-Fiber (RoF) communication system
Shuhu Tan, Xuejie Wang, Yongqing Huang, Kai Liu, Xiaofeng Duan, Xiaomin Ren
Beijing University of Posts and Telecommunications, China
We propose a high-power MUTC photodiode operating at 1310nm band. The 20μm photodiode with a dual Gaussian doping structure exhibits over 30GHz of 3dB bandwidth, 37.2dBm@15GHz of peak RF output power, and 0.82A/W of responsivity.

ACPPOEM-0730-39
Design and Simulation of Highly Efficient Chirped Blazed Grating Coupler Based on Thin-Film Lithium Niobate
Min Liu[1], Guangshuai Meng[1], Binhang Xu[1], Jing Du[1,2], Jian Wang[1,2], Junqiang Sun[1]
1.Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
We design a chirped blazed grating coupler based on TFLN using particle swarm optimization. The results show that the coupler has a coupling efficiency of -1.56 dB and a 3 dB bandwidth of 67.28 nm.

ACPPOEM-0731-4
Impact of Gamma-Ray Radiation on High Speed Silicon Optical modulators
Nengyang Zhao[1], Longsheng Wu[1], Chao Qiu[1], Dawei Bi[1], Yanyue Ding[1], Enxia Zhang[2], Aimin Wu[1]
1.Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China; 2.Department of Electrical and computer engineering, University of Central Florida, United States
The performance of MZMs was studied under gamma-ray radiation. The experiments showed when the total dose of radiation reached 10Mrad(Si), the influence on modulation efficiency of MZMs was negligible. However, the EO-bandwidth decreased by 13%.

ACPPOEM-0731-13
Ertical Impedance-Matched Photodetectors for High-Power Applications
Tianlang Yang, Xiangyang Dai, Qiaoyin Lu, Weihua Guo
Huazhong University of Science and Technology Wuhan photoelectric National Research Center, China
A small area waveguide photodiode is designed, which can achieve stable and uniform photocurrent, photocurrent fluctuation 0.05dB/μm, response 0.5A/W, and meet the requirements of high speed and high power operation.

ACPPOEM-0731-18
Deep reinforcement learning based on optical neural networks in path planning
Zhiwei Yang, Yihang Lai, Jian Dai, Tian Zhang, Kun Xu
Beijing University of Posts and Telecommunications, China
We propose the optical deep Q network (ODQN) algorithm based on optical neural networks (ONNs) to accelerate calculation and prove the relatively good robustness of the ODQN algorithm in 2D grid path planning task.

ACPPOEM-0731-23
Investigation of collimation and polarization characteristics of multimode VCSEL based on metasurface optoelectronic integration
Pan Fu, Xiaorui Zhao, Bo Wu, Yiyang Xie
Beijing University of Technology, China
We propose a method based on metasurface optoelectronic integration to realize the collimation of multimode VCSEL and explore their polarization characteristics. This study provides valuable guidance for VCSEL in mode and polarization multiplexing.

ACPPOEM-0731-26
Design of 1550 nm High-power Single-mode DBR Laser Diodes
Qianru Lu[1], Yuanhao Zhang[1], Minwen Xiang[1], Can Liu[2], Qiaoyin Lu[1], GuoWeihua[1]
1.Huazhong University of Science and Technology, China; 2.Ori-chip optoelectronics technology LTD, China
We present an 8-μm-wide 1.5-mm-long high-power and single-mode DBR laser. The designed laser has been predicted with a threshold current of about 88 mA and a slope efficiency of about 0.28 mW/mA.

ACPPOEM-0731-34
Continuous THz-wave generation using antenna-integrated MUTC-PD and DFB laser array
Chaodan Chi[1], Yingfei Wan[1], Yiti Xiong[1], Yili Liu[1], Zhangwan Peng[2], Hao Wang[3], Dan Lu[3], Kun Yin[1], Chen Ji[2]
1.Zhejiang Lab, China; 2.Zhejiang University, China; 3.Key Laboratory of Semiconductor Materials Science Institute of Semiconductors, CAS, China
In this paper, photonic generation of continuous terahertz waves is demonstrated using our internal designed antenna-integrated MUTC-PD and DFB laser array chip, and signal from 0.027 to 0.641 THz is demonstrated.

ACPPOEM-0731-35
Continuous-wave Terahertz Mode-beating Signal Generation Based on High-power Multi-wavelength DFB Semiconductor Laser Array
Yingfei Wan[1], Chaodan Chi[1], Yiti Xiong[1], Yili Liu[1], Wanshu Xiong[1], Kun Yin[1], Hao Wang[2], Dan Lu[2], Chen Ji[3]
1.Zhejiang Lab, China; 2.Key Laboratory of Semiconductor Materials Science Institute of Semiconductors, Chinese Academy of Sciences, China; 3.College of Information Science and Electronic Engineering Zhejiang University, China
We report a high-power multi-wavelength DFB diode laser array that can generate continuously tunable THz signals in the frequency range of 0.075 to 2.23 THz through optical heterodyne method.

ACPPOEM-0731-45
Photonic Chip Set for Terahertz Frequency 45 Gb/s Data Transmission
Yiti Xiong, Yingfei Wan, Chaodan Chi, Yili Liu, Yanhui Shi, Kun Yin, Hao Wang, Dan Lu, Chen Ji
Zhejiang Lab, China
We experimentally demonstratea 45 Gb/s terahertz data transmitter with continuously tunable terahertz signals in 110-219 GHz, based on an internally developed 1550 nm photonic chip set, including DFB lasers, a MZM and a UTC-PD.

ACPPOEM-0731-58
Efficient On-Chip Training of Optical Processor Using Stochastic Parallel-Gradient-Descent Algorithm
Yuanjian Wan[1,2], Xudong Liu[1,2], Guangze Wu[1,2], Yu Zhang[1,2], Jian Wang[1,2]
1.Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
We use stochastic parallel-gradient-descent algorithm to configure optical processor, which has less computation than traditional gradient descent algorithms. We apply it in optical communication system for compensating the crosstalk in space division multiplexing systems.

ACPPOEM-0731-63
Mid-infrared supercontinuum generation in a cascaded silicon ridge waveguide by a low-energy picosecond pulse
You Wu, Jiajia Zhao, Qian Li
School of Electronic and Computer Engineering, Peking University, Shenzhen, China
We propose an approach to generate a mid-infrared supercontinuum with a wide bandwidth of 1490 nm and high coherence in a two-segment cascaded silicon ridge waveguide, which is pumped by a 4.5-pJ picosecond pulse.

ACPPOEM-0731-81
A laser-to-chip edge coupling scheme based on novel dual lens
Yili Liu, Tian Chai, Chaodan Chi, Yingfei Wan, Yiti Xiong, Shuo Liu, Wanshu Xiong, Kun Yin, Chen Ji
Zhejiang Lab, China
A novel high-tolerance coupling configuration of DFB lasers to silicon photonic chips based on the dual-lens is discussed. The high-tolerance and high-coupling-efficiency dual-lens solution iseasy to assemble for the silicon photonics integration.

ACPPOEM-0731-82
An Image-free Location Method Using Photonic Integrated Interferometric System
Xiaohan Song, Yong Zuo, Wang Yuhao, Xiaobin Hong, Jian Wu
Beijing University of Posts and Telecommunications, China
Object location technology has wide application prospects in the military, sports, security, transportation and other fields. This paper proposes an image-free target location method by combining photonic integrated circuits and the Fourier projection slicing theorem.

ACPPOEM-0731-91
Design and optimization of high-impedance transmission line electrode for high-power and high-bandwidth photodetector
Xiaodong Xie, Yongqing Huang, Shaoyu Wang, Xuejie Wang, Xiaofeng Duan, Kai Liu
Beijing University of Posts andTelecommunications, China
This paper proposes and adopts a co-simulation method to design an electrode with a high-impedance transmission line to enhance the output power and bandwidth of the photodetector.

ACPPOEM-0731-111
Angular response improvement of a Fabry-Perot tunable filter for infrared multispectral imaging
Can Chen[1,2], Yang Chenlong[1,2], Zhou Jiajun[2,3], Lai Jianjun[1,2]
1.Wuhan National Laboratory for Optoelectronics, China; 2.Huazhong University of Science and Technology, China; 3.School of Opitcal and Electronic Information, China
A Fabry Perot tunable filter with stable bandwidth has been designed for infrared multispectral imaging. Sub-wavelength metasurfaces are introduced on the inner sides of high reflection cavity mirrors to lessen the angular influence.

ACPPOEM-0731-117
Wide Bandwidth Wavelength combination for 50G-PON through adiabatic 3-dB coupler based on asymmetric MZI
Panpan Yu, Guojiong Li, Yuheng Pan, Liyuan Song, Juan Xia, Jieru Zhao, Yongqian Tang, Qiaoyin Lu, Weihua Guo
Huazhong University of Science and Technology, China
Photonic integrated wavelength combination through an asymmetric Mach-Zehnder interferometer was proposed. It contains an adiabatic 2´2 coupler and a multi-mode interference splitter, which enables the input of 1342 and 1490 nm to couple into one output port. The transmission efficiency of the wavelength combining is more than 90% at the wavelength of 1342-1577 nm. The wavelength beam combination scheme proposed above is an attractive candidate for 50G-PON wavelength division multiplexing based on the TFLN photonic integration platform.

ACPPOEM-0731-124
High Performance Adiabatic Polarization Rotator-Combiner Based on Thin-Film Lithium Niobate Platform
Panpan Yu, Yuheng Pan, Yongqian Tang, Xiangyang Dai, Juan Xia, Jieru Zhao, Guojiong Li, Qiaoyin Lu, Weihua Guo
Huazhong University of Science and Technology, China
We experimentally demonstrate a polarization rotator-combiner based on thin-film lithium niobite with wide bandwidth and high polarization extinction ratio. The device fabricated by standard photolithography has a large fabrication tolerance and provides a PER 20 dB in the wavelength range of 80 nm.

ACPPOEM-0731-143
Modified dual depletion region photodiode with optimized collection layer
Xinyue Li, Xiaofeng Duan, Jihong Ye, Yongqing Huang, Kai Liu, Xiaomin Ren
Beijing university of posts and telecommunications, China
Using two layers of InGaAsP with different components as the non-absorption depletion region of the Dual Depletion Region Photodiode (DDR-PD), a Modified Dual Depletion Region Photodiode (MDDR-PD) is proposed. Eventually, the device achieved 67GHz bandwidth.

ACPPOEM-0731-169
PLC Splitter Encoded with Waveguide Bragg Grating by Femtosecond Laser Inscribing Technique for PON Monitoring
Jin Hu[1], Xu Liu[1], Lin Ma[1], Heyuan Li[2], Zuyuan He[1]
1.State Key Laboratory of Advanced Optical Communication Systems and Networks,Shanghai Jiao Tong University, China; 2.Zhejiang Lab, China
We demonstrate PLC splitter encoded by Bragg waveguide gratings with a wavelength interval of 4 nm and an adjustable reflectanceup to 40% using a femtosecond laser inscribing technique for passive optical network monitoring applications.

ACPPOEM-0731-172
Non-volatile photonic synapse with ultra-low insertion loss for deep neural network
Zhiqiang Quan, Ma Xiaoxiao, Yuanjian Wan, Jian Wang
Huazhong University of Science and Technology, China
Neuromorphic computing underlies many computational tasks, from signal processing to classification, artificial intelligence, and deep learning applications. Compared with the traditional Von Neumann architecture, the non-volatile photonic neural network adopts the in-memory computing architecture to improve the computing speed and reduce the computing energy consumption. The non-volatile photonic neural network consists of photonic synapses with linear responses and nonlinear activation functions. However, existing non-volatile photonic neural synapses with large insertion loss (IL) and small output intensity modulation range hamper the construction of the deep neural network (DNN) with multiple hidden layers for high-accuracy complex signal recognition. Here, we show a non-volatile synapse with excellent performance to construct the non-volatile deep neural network (NVDNN). The obtained results show that the IL and output intensity modulation range of our photonic synapse is 0.01 dB and 30.03 dB with a 54 nm 3 dB bandwidth. For the complex picture classification task, the NVDNN based on our photonic synapse has a higher accuracy compared with the single-layer non-volatile photonic neural network. Our results demonstrate how to design non-volatile synapses and construct complex optical neural networks, and reveal their advantages in information processing capabilities.

ACPPOEM-0731-179
A computational algorithm for design of dual-etched grating couplers on 220-nm SOI platform
Lihang Wang, Jifang Qiu, Lan Wu, Yuchen Chen, Hongxiang Guo, Jian Wu
State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China
A three-step computational algorithm for designs of dual-etched grating couplers is proposed. By modulating different unit grating structures, a high-performance grating coupler, compatible with deep ultraviolet lithography, reaches a coupling efficiency of 64.5% and a 3-dB bandwidth of 70nm, validating the efficacy of this algorithm.

ACPPOEM-0731-187
A compact AR-HUD system based on 1-D pupil expansion diffractive waveguide
Han Yang, Gaoyu Dai, Ren Kailin, Yin Luqiao, Zhang Jianhua
Shanghai University, China
A one-dimensional pupil expansiondiffractive optical waveguide system for AR-HUD is presented, with an expanded pupil size of 80 mm × 15 mm and a field of view of 10° × 5° at the wavelength of 532 nm.

ACPPOEM-0801-5
Narrow spectral linewidth O-band quantum dot distributed feedback lasers
Lin Shizhe, Ding Zhengqing, Zhan Kun, Cai Minghao, Yu Ying, Yu Siyuan
Sun Yat-Sen University, China
A 1.3 μm GaAs-based QD-DFB laser with integrated FP cavity has been fabricated. The laser have a tuning range of 5.21 nm, with alinewidth of 140 kHz and a highest SMSR of 48 dB.

ACPPOEM-0801-12
Design and Simulation of Low-Loss Multimode B-spline Waveguide Bends Based on Lithium Niobate on Insulator
Binhang Xu[1], Min Liu[1], Guangshuai Meng[1], Jing Du[1,2], Jian Wang[1,2], Junqiang Sun[1]
1.Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
We design and simulate low-loss multimode B-spline waveguide bends based on lithium niobate on insulator assisted by Equilibrium optimizer. The results also show favorable crosstalk properties.

ACPPOEM-0801-27
Low-loss and broadband edge coupler for cleaved single mode fiber and lithium niobate waveguide
Zhenmin Chen[1], Xin Tu[2], Chen Zhang[1], Zhengtong Liu[1]
1.Peng Cheng Laboratory, China; 2.China University of Geosciences, China
A double-forked shape edge coupler has been presented base on LNOI. The coupling loss of TE mode is 0.92 dB with the cleaved single mode fiber. The 3-dB alignment tolerance can reach more than ±4 mm.

ACPPOEM-0801-46
Deformed Square Microcavity Semiconductor Lasers With Dual Transverse Modes
Yang Shi[1,2], Hang-Dong Wei[1,2], You-Zeng Hao[1,2], Yue-De Yang[1,2], Jin-Long Xiao[1,2], Yong-Zhen Huang[1,2]
1.Institute of Semiconductors, Chinese Academy of Sciences, China; 2.Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, China
Deformed square microcavity semiconductor lasers with pure dual-transverse-mode lasing spectra are designed and demonstrated. Two opposite circular vertices deformation are used to enlarge the dual mode interval that can be adjusted by changing the deformation.

ACPPOEM-0801-48
Mode Control for Octagonal Microcavity Lasers
Zhenning Zhang[1,2], Jiancheng Li[1,2], Youzeng Hao[1], Mengwei Sheng[1,2], Yuede Yang[1,2], Jinlong Xiao[1,2], Yongzhen Huang[1,2]
1.Institute of Semiconductors, Chinese Academy of Sciences, China; 2.Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, China
A bistable deformed octagonal microcavity laser is demonstrated. A counterclockwise hysteresis loop is observed with the current range of 17 mA.The direct modulation bandwidth is increased to 16 GHz through the photon-photon resonance effect.

ACPPOEM-0801-96
Packaged ultra-high-quality optical whispering gallery mode microresonators with air tightness and 3-axis adjustment
Haiyun Yuan[1,2,3,4], Hairun Guo[1,2,3,4], Suwan Sun[1,2,3,4], Jiamin Bai[1,2,3,4], Siyu Wang[1,2,3,4]
1.Key Laboratory of Specialty Fiber Optics and Optical Access Networks, China; 2.Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, China; 3.Shanghai University, China; 4.Shanghai Institutefor Advanced Communication and Data Science, China
Whispering gallery mode (WGM) microcavity has become an important platform for optical research and application due to its ultra-high quality factor (Q-factor) and low mode volume. However, the surface of crystalline microcavities and fiber-microcavity system is extremely sensitive toenvironment. The optimal coupling between WGM microcavity and tapered fiber depends heavily on observation of optical microscope and adjustment of precision mechanical instruments. In this paper, we present a novel packaged device for high-quality WGM MgF_2 and SiO_2 microcavities with 3D adjustment, good portability and high air tightness, which not only ensures the long-term stability of the microcavities' Q factor, but also realizes the real-time control of fiber-microcavity coupling system. The proposed device has shown potential for onsite applications outside the laboratory frame.

ACPPOEM-0801-115
Effect of Phase Noise on Electro-optic Frequency Combs Using Integrated Lithium Niobate Modulators
Pengfei Liu[1], Hao Wen[1], Zuhang Li[1], Yu Yu[1,2], Lei Shi[1,2], Xinliang Zhang[1,2]
1.Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China
Electro-optic (EO) frequency combs have played a critical role in high-capacity optical communications, microwave photonics, and spectroscopy. These applications require EO frequency combs featuring good flatness and strong coherence, however, high phase noise severely degrades the performance of EO frequency combs. Here, we demonstrated an on-chip EO frequency comb generator based on thin-film lithium niobate modulators, and we analyzed the effect of phase noise on integrated EO frequency combs.

ACPPOEM-0801-118
Automated Design of FSR-Free Silicon Photonics Microring Filters Based on Sparse Spectral Response
Yu Chen[1], Meilin Zhong[1], Gangxiang Shen[1], Gordon Ning Liu[1], Wei Cao[2], Xu Sun[2], Xiaogang Chen[2], Shenghao Liu[2]
1.School of Electronic and Information Engineering, Soochow University, China; 2.Silicon Photonics R&D Center, CreaLights Technology Co., Ltd., China
We present an automated design method for FSR-Free silicon photonics microring filter. The sparsity of the filter spectral response is utilized as an evaluation metric. Simulation results demonstrate the effectiveness and superiority of the proposed method.

ACPPOEM-0801-151
Mode-switching based Reconfigurable Optical Power Splitter for Channel Scalable and MSA-compatible Optical Interconnects
Xinyi Wang, Jiangbing Du, Zuyuan He
Shanghai Jiao Tong University, China
We proposed a mode-switching based reconfigurable optical power splitter with channel number scalability covering 1, 2, 4, and 8 channels, which can be used for versatile MSA-compatible optical interconnects with minimal switching control and large bandwidth.

ACPPOEM-0801-156
A 4-channel ultrafast wavelength-swept REC-DFB laser array for fiber Bragg grating interrogation
Lingxin Meng[1], Pan Dai[1], Qilu Ban[1], Kaichuan Xu[1], Jiacheng Wang[1], Zhen Li[1], Feng Wang[1], Jie Zeng[2], Shaobo Li[3], Xiang Ma[3], Xiangfei Chen[1]
1.Nanjing University, China; 2.Nanjing University of Aeronautics and Astronautics, China; 3.Optical Communication Research and Development Center, the 54th Research Institute of China Electronics Technology Group Corporation, China
We present a four-channel ultrafast wavelength-swept REC-DFB laser array based on instantaneous injection current modulation. A fast tuning of over 16nm at 100kHz sweeping was achieved and four FBG temperature sensor arrays were successfully demodulated.

ACPPOEM-0809-2
Design of UTC-PD With Nanoscale Optical Microstructures
Junjie Wang[1,2], Kai Liu[1,2], Xiaowen Dong[1,2], Xiaofeng Duan[1,2], Yongqing Huang[1,2], Honggang Zhai[3]
1.School of Electronic Engineering, Beijing University of Posts and Telecommunications, China; 2.State Key Laboratory of Information Photonics and Optical Communications Beijing University of Posts and Telecommunications, China; 3.Ccloud Electro Optics Technology Co. Ltd, China
We design a UTC-PD incorporating nanoscale optical microstructures. It includes a waveguide structure and scattering structure to convert incident light from vertical incidence to lateral propagation and constrain it within the absorption layer, thereby the responsivity of UTC-PD is improved.

ACPPOEM-0809-5
Ultra-Compact Silicon-on-Chip Photonic Devices Based on Inverse Design
Maojing Hou, Ruiqi Luo, Nan Liu, Qiao Wang, Guandong Liu, Wei Ma
Zhejiang Laboratory, China
Our work designed two kinds of silicon optical devices based on inverse design, one is an ultra-compact taper with a length of only 5μm, which has a wide operating frequency band from 1500nm to 1600nm, and the average insertion loss is about -2 dB. Anotheris an O-band polarization-independent wavelength division Multiplexing (WDM) device with an insertion loss of -3 db.

ACPPOEM-0813-8
Ultra-compact Silicon Waveguide Mode Converting Reflector Based on Inverse Design
Shanglin Yang[1], Yue Yu[1], Han Zheng[1], Tong Zhang[2]
1.School of Optoelectronic Engineering, Xidian University, China; 2.School of Automation Science and Engineering, Xi'an Jiaotong University, China
We design an ultra-compact silicon waveguide mode-converting reflector based on photonics inverse design, which converts TE_0 mode to TE_1 mode and reflects light within $2 \times 2\ \mu m^2$.

ACPPOEM-0813-10
Fast Wavelength Locking of Thermally Tunable Silicon Vernier Microring Filter over the O-band
Guangze Wu[1,2], Yuanjian Wan[1,2], Yu Zhang[1,2], Jian Wang[2,3]
1.Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.Optics Valley Laboratory, China; 3.Optoelectronics and School of Optical and Electronic Information, Huazhong University of Science and Technology, China
We experimentally demonstrate fast wavelength locking of thermallly tuned silicon Vernier microring filter over the O-band by using the improved stochastic parallel-gradient-descent algorithm.

ACPPOEM-0814-5
800G Receiver Integrated Chip based on Tunable Etched Diffraction Grating
Nan Liu, Ruiqi Luo, Maojing Hou, Qiao Wang, Guandong Liu, Wei Ma
Zhejiang Lab, China
An 800G receiver integrated chip based on tunable EDG is reported. A single thermo-optic tuning process allows for the correction of the integrated chip's operating wavelength, achieving a single-wavelength transmission rate of 100Gbps.

ACPPOEM-0814-32
Design and Characterization of Line-Defected Silicon Waveguide and High-Q Optical Cavity
Sohail Muhammad
University of Electronic Science and Technology of China, China
The development of optical devices has become increasingly important in the miniaturization of integrated circuits, and photonic crystals (PhCs) have emerged as a promising platform for such devices. In this paper, we propose a broadband Silicon waveguide operating at telecommunications wavelengths ($\lambda 0 \sim 1550$ nm), which utilizes a silicon-based 2D photonic crystal to achieve a high transmission rate. Our simulation results show that by optimizing the width of the waveguide and radius, we can improve the transmission rate and adjust the passband region wavelength range. Specifically, for a waveguide width of 0.25um, the transmission rate varies from 83% to 92%, with a passband region wavelength range of 1480nm to 1670nm. For a wider waveguide width of 0.5um, the transmission rate varies from 75% to 95%, with a wider passband region wavelength range of 1550nm to 1720nm. Furthermore, we designed a high Q hexagonal lattice photonic crystal optical cavity based on Silicon with a thickness of 0.5um. Our simulation results demonstrate a high-quality factor of 52548 at 188.375THz. Our proposed broadband Silicon waveguide and photonic crystal cavity have potential applications in various areas, including telecommunications, sensing, and quantum information processing.

ACPPOEM-0814-56
Flat-Top, Narrow-Band, Thermally Tunable Optical Filters Based on Multi-Phase-Shifted Bragg Gratings and Suspended Waveguide
Lian Zhu, Long Chen, Yonglin Yu, Kaixiang Cao, Yuan Yu
Huazhong University of Science and Technoloy, China
Tunable optical filters are key components in optical communication systems. In this paper, a multi-phase-shifted Bragg gratings (MPSBGs) filter based on a laterally supported suspended waveguide is designed and fabricated. Optimized design of phase-shift segments location and length in MPSBGs combined with thermal tuning of the suspended waveguide to achieve a flat-top, narrow-band filter response. By tuning the heater in the phase shift section, a transmission window with a -3 dB bandwidth of 270 pm is obtained, while out-of-band rejection of is about 30 dB, shape factor (the ratio of -20 dB to -3 dB bandwidth) is 2.3, and thermal tuning efficiency is about 40 pm/mW.

ACPPOEM-0814-64
Experimental Investigation on Chirp Characteristics of 3s-DBR Lasers
Jiashi Feng, Haixuan Xu, Yonglin Yu
Huazhong University of Science and Technology, China
The chirp parameters of a 3s-DBR laser are characterized. Experimental results show that the LEF can decrease with tuning the grating section, confirming the detuned loading effect on the chirp property from a new perspective.

ACPPOEM-0815-33
A novel thermo-optic phase shifter based on anti-symmetric Bragg grating
Shengping Liu[1], Qiang Li[1], Yang Zhao[1], Wei Wang[1], Guoguang Yao[1], Shang Gao[1], Junbo Feng[1], Qipeng Zhan[2], Yong Tang[3], Yao Xiao[3]
1.Chongqing United Microelectronics Center, China; 2.Anhui University, China; 3.University of Electronic Science and Technology of China, China
Thermo-optic phase shifter (TOPS) plays an important role in the silicon photonics integrated circuits. In this article, we proposed and experimentally demonstrated a novel TOPS based on the anti-symmetric Bragg grating (ASBG). By using the ASBG and anti-directional coupler, the overlap integral of light field and thermal field is increased by three times. The TOPS has been fabricated on CUMEC's standard CSiP180Al and CSiP130Cu silicon photonics platform. The experimental results show that the efficiency of the TOPS is about 6.75mW/π, which is only about a third of the conventional TOPS. At the same

time, the rise time and drop time are only 7.1 μs and 9.7 μs. The proposed TOPS based on the ASBG paves the way for a high efficiency TOPS for the silicon photonics integrated circuits without sacrificing the switching time.

ACPPOEM-0815-43
Low Power Consumption Supercontinuum Source in the Dispersion Engineered Silicon Nitride Waveguides
Ruifeng Chen, Feng Ye, Jiayao Huang, Qian Li
Peking University Shenzhen Graduate School, China
We introduce a scheme for supercontinuum generation with relatively low power consumption and better coherence through the incorporation of additional frequency components in the dispersion-engineered silicon nitride waveguides.

ACPPOEM-0815-52
Ultra-compact Silicon-based Three Mode Splitter via Inverse Design Method
Jinhua Chen, Weiwei Pan, Yu Cheng, Xudong Du, Tao Shi, Chen Ji
Zhejiang University, China
We proposed an ultra-compact and broadband three mode splitter with a footprint of only 5*5.2 um^2 based on silicon photonics platform. The device is optimized by the topology optimization-based inverse design method.

ACPPOEM-0815-54
Non-Hermitian Silicon Nitride Microring Resonators with Large Tunable Bandwidth
Yuchen Yin, Xuhan Guo, Yikai Su
Shanghai Jiao Tong University, China
We propose a non-Hermitian silicon nitride (Si_3N_4) microring resonators (MRRs) with a large tunable bandwidth from 5.4 GHz to 97.3 GHz and a large free space range (FSR) using an efficient titanium (Ti) heater.

ACPPOEM-0815-56
On-chip microdisk resonator wave-meter
Jianfei Sun
Shanghai Jiao Tong University, China
We demonstrate an on-chip wave-meterimplemented using microdisk resonators. The device exhibits robust resistance to environmental interference. The utilization of machine learning classification algorithms enables achieving high resolution and accuracy in spectral analysis.

ACPPOEM-0815-81
Mitigating Fast Thermal Instability by Engineered Laser Sweep in AlN Soliton Microcomb Generation
Zihao Wang[1], Kewei Liu[1], Shunyu Yao[1], Yanan Guo[2,3], Jianchang Yan[2,3], Junxi Wang[2,3], Changxi Yang[1], Chengying Bao[1]
1.State Key Laboratory of Precision Measurement Technology and Instruments, Department of Precision Instruments, Tsinghua University, China; 2.Center for Materials Science and Optoelectronics Engineering, University of the Chinese Academy of Sciences, China; 3.Research and Development Center for Solid State Lighting, Institute of Semiconductors, Chinese Academy of Sciences, China
Transient thermal instability represents a significant challenge in generating soliton microcombs.Here, we engineer the laser sweep waveform to generate AlN-on-sapphire soliton microcombs with an intermediate sweep speed (30 GHz/μs).

ACPPOEM-0815-82
High Speed Single-Mode Surface-Emitting DFB Laser
Nanguo Li[1], Can Liu[2], Guojiong Li[1], Juan Xia[1], Qiaoyin Lu[1], Weihua Guo[1]
1.Wuhan National Laboratory for Optoelectronics, China; 2.Ori-chip Optoelectronics Technology LTD, China
High speed single mode surface emitting distributed feedback laser has been presented. The equivalent circuit model is established. The effect of parasitic parameters on the high speed modulation characteristics of the device is analyzed and calculated.

Track 5: Microwave Photonics and Optical Signal Processing

ACPPOEM-0718-3
On-Chip Constant-Coefficient Second-Order Differential Equation Solver Based on Microdisk with Dual-Mode Alignment
Jiahao Zhou, Pengxing Guo, Zhengrong You, Zimo Wang, Kun Liu, Weigang Hou, Lei Guo
Chongqing University of Posts and Telecommunications, China
This paper proposed an all-optical constant coefficient second-order ordinary differential equation solver based on a single microdisk resonator with dual-mode alignment. The device footprint is approximately 20×30 $μm^2$, and the Q-factor reaches $9.8×10^4$.

ACPPOEM-0725-12
Denoising convolutional neural network for wideband frequency modulation signals based on microwave photonic down-conversion
Shilin Chen[1,2], Tao Pu[1], Li Wang[3], Zheng Jilin[1], Gengze Wu[1], Jin Li[1], Xin Zhang[4], Jiaqi Zhao[1]
1.Army Engineering University of PLA, China; 2.Nanjing Vocational College of Information Technology, China; 3.Nanjing University of Science and Technology ZiJin College, China; 4.College of Information and Communication, National University of Defense Technology, China
The denoising convolutional neural network (DnCNN) algorithm is introduced into the microwave photonics down-conversion system to alleviate the system noise and reduce the number of radar false alarms, which is proposed and demonstrated.

The noise characteristics of the broadband signal after fast Fourier transform are learned by training the network, and the noise reduction and enhancement of the signal are realized. The simulation results show that the peak-to-floor ratio (PFR) of the triangular frequency modulation down-conversion signal is increased by about 23.2 dB, which greatly improves the detection ability of the radar, especially the weak target detection ability.

ACPPOEM-0726-6
Super-resolution of near-field SAR imaging based on deep convolutional neural network
Peng Chen, Qin Junjie, Ming Ziwei, Yang Zhengang, Wang Kejia, Liu Jinsong
Huazhong University of Science and Technology, China
We built a deep convolutional neural network to realize the imaging super-resolution of 24-30GHz near-field SAR imaging system. The results show that this method can effectively remove background noise and improve the clarity of imaging.

ACPPOEM-0727-3
Nonlinear Distortion Mitigation via Coherent All-Optical Reservoir Computing for Long-Haul IM-DD transmission Systems
Guanju Peng[1], Yaping Liu[1], Zheng Li[1], Kunpeng Zhu[1], Zhiqun Yang[1], Jianping Li[2], Shigui Zhang[2], Zhanhua Huang[1], Lin Zhang[1,3]
1.Tianjin University, China; 2.HMN Technologies Co., Ltd, China; 3.Peng Cheng Laboratory, China
We propose a coherent all-optical reservoir computing for nonlinear equalization in 3960-km transmission scenarios. It can improve the Q^2 factor by 2.6 dB for a single-wavelength system and 1.9 dB for a7-channel WDM system.

ACPPOEM-0727-15
A Wideband Spread Spectrum Microwave Photonic Transceiver Architecture With Coherent Dual Carriers And Superheterodyne Down Conversion
Weifeng Su, Naijin Liu, Guangyu Gao, Qijun Liang, Qiang Zhao, Ziyu Liu, Xiang Yan
Qian Xue Sen Laboratory of Space Technology/China Academy of Space Technology, China
In this paper, we propose and demonstrate a novel microwave photonics architecture consisting of a transmitter and a receiver, designed for spread spectrum communication. The transmitter is capable of spreading and up-converting a baseband signal to a wideband spread spectrum signal at a frequency of 10 GHz. On the other hand, the receiver can despread and down-convert the wideband spread spectrum signal back to the baseband signal. The architecture exhibits remarkable capabilities in handling large instantaneous bandwidth signals across a wide operating band, making it suitable for various application scenarios. Additionally, our experimental results highlight the architecture's excellent performance in image suppression (up to 56 dB) and dynamic range (SFDR3: 127.2 dB $\cdot Hz^{2/3}$).

ACPPOEM-0729-6
A High-Throughput QC-LDPC Encoder
Yifan Ding[1,2], Qiang Cao[1,2], Jie Yao[1,2]
1.Wuhan National Laboratory for Optoelectronics, China; 2.Huazhong University of Science and Technology, China
Low Density Parity Check (LDPC) codes have been widely used in communication and storage fields to support high reliability of data channel. Quasi-cyclic (QC)-LDPC as a regular code can sufficiently exploit hardware parallelism of Field-Programmable Gate Array (FPGA) to accelerate the encoding/decoding performance. However, existing FPGA encoders are generally dedicated to a specialized LDPC code and hardware platform with limited flexibility. In this paper, to achieve high throughput and flexibility simultaneously, we propose a High-level synthesis (HLS) based QC-LDPC encoder microarchitecture. The encoder designs a fine-grained partially-parallel iterative process execution to exploit intra-codeword parallelism by fully leveraging capability of HLS . The proposed encoder further optimizes data-layout and HLS-function implementation. The encoding throughput of the proposed encoder achieves 98.4Gbps higher than the state-of-the-art QC-LDPC encoder.by up to 14.75X.

ACPPOEM-0729-7
A High-accuracy Progressive Training Scheme to Combat the Recognition Error of MZI-ONN
Zhengrong You, Pengxing Guo, Jiahao Zhou, Kun Liu, Zimo Wang, Weigang Hou, Lei Guo
Chongqing University of Posts and Telecommunications, China
This paper proposes a progressive training scheme to configure the phase shift in MZI-based feedforward ONN. The simulation results show that the proposed scheme can improve the recognition accuracy of the ONN average by 39%.

ACPPOEM-0730-17
Photonics-based microwave signal replication with low noise figure using a hybrid amplifier
Yifan Pu, Zhongyang Xu, Shilong Pan
Nanjing University of Aeronautics and Astronautics, National Key Laboratory of Microwave Photonics, China
We propose an optical fiber replication loop with a low noise figure, in which a hybrid optical amplifier consisting of an erbium-doped fiber amplifier and a Raman fiber amplifier is used. Numeric simulations are implemented. It is shown that the microwave signal can be replicated with a noise figure (NF) around 2 dB. It is of significance for applications such as recirculating memory loop and microwave frequency measurement.

ACPPOEM-0730-18
Impact of Unbalanced Interferometers on Laser Frequency Sweep Linearization
Gang Hu, Zhongyang Xu, Hangtian Lu, Xiuyuan Sun, Shilong Pan
National Key Laboratory of Microwave Photonics, Nanjing University of Aeronautics and Astronautics,China
Laser frequency sweep linearization is achieved using an auxiliary unbalanced interferometer, in which the impact of the fiber delay line is analyzed. The short fiber delay line reduces the linearization accuracy and ranging resolution. In the experiment, ranging resolution can be enhanced by eight times if the fiber delay line length is lengthened from 10 cm and 5 m. For the fiber shorter than 1 m, it is infeasible to obtain a residual nonlinearity smaller than 10^{-7}. This work gives the limitation of fiber length in the auxiliary interferometer for laser frequency sweep linearization.

ACPPOEM-0730-19
Microwave Radar System Based on Chaotic Photonic Compressed Sensing
Anran Li, Ning Jiang, Qiang Zhang, Huanhuan Xiong, Yiqun Zhang, Gang Hu, Yongsheng Cao, Kun Qiu
University of Electronic Science and Technology of China, China
A radar system utilizing chaotic photonic compressed sensing is proposed for distance and velocity measurements of a target. All the de-chirped frequencies are reconstructed with a compression ratio of 8 under an acceptable error range.

ACPPOEM-0730-34
Side-peak suppression in the microwave frequency comb using an optical injected semiconductor laser with optoelectronic feedback
Wei Chen, Chenpeng Xue Xue, Zuxing Zhang
Nanjing University of Posts and Telecommunications, China
Side peaks in microwave-frequency-comb corresponding to the optoelectronic feedback would increase with increasing of the delay time. The study presents it can be optimized by setting appropriate delay-time offset and introducing the third feedback loop

ACPPOEM-0730-35
Narrow Linewidth Measurement based on Adaptive Extended Kalman Filter Algorithm
Xiaoyu Zhang, Yangan Zhang, Xueguang Yuan
Beijing University of Posts and Telecommunications, China
A pioneering approach is introduced in this paper, which utilizes the adaptive extended Kalman filter algorithm to measure spectral linewidths of narrow-linewidth lasers. The effectiveness and dependability have been confirmed by field experiment.

ACPPOEM-0731-33
A -70 dBm High-Sensitivity AGC Algorithm for PPM-APD Low-Power FSOC Systems
Yi'nan Li[1,2], Jiaji Chen[1], Xiaowei Wu[1], Lei Yang[1]
1.Technology and Engineering Center for Space Utilization,Chinese Academy of Sciences, China; 2.University of Chinese Academy of Sciences, China
Automatic gain control (AGC) is essential for improving the sensitivity and dynamic range of receiver in free space optical communication (FSOC) systems. In this paper, we investigate an AGC algorithm for a typical low-power FSOC system with pulse position modulation (PPM) and avalanche photodiode (APD). Conventional average/peak detection methods are inadequate for measuring signal strength in the PPM-APD FSOC systems due to the low received power and pulse sparsity. To overcome this issue, we propose a high-sensitivity signal strength estimation (SSE) method based on correlation detection. Then, we design an AGC algorithm that maximizes the output signal-to-noise ratio (SNR) of the APD. The proposed SSE algorithm can retain a sensitivity of -70 dBm. The designed AGC algorithm achieves a dynamic range of at least 20 dBm and reduces the bit error rate (BER) of demodulation by 1 to 4 orders of magnitude under a 20 Mbps rate and 16-PPM format near the decoding threshold.

ACPPOEM-0731-73
Millimeter wave generation based on photodetector nonlinearity
Mingxi Yang, Yongqing Huang, Jihong Ye, Xiaofeng Duan, Kai Liu, Xiaomin Ren
Beijing University of Posts and Telecommunications, China
In this paper, we investigated the nonlinear mechanism of photodetectors. A method for generating millimeter wave signals using nonlinear frequency-doubling effect was proposed and experimentally verified.

ACPPOEM-0731-96
Design of Multi-functional reconfigurable microwave photonic chip
Xiaohang Zhang[1], Chaotan Sima[1], Tailin Li[1], Qazi Salman Ahmed[2], James C. Gates[2], Peter G. R. Smith[2]
1.Next Generation Internet Access National Engineering Research Centre, School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.Optoelectronics Research Centre, University of Southampton, Highfield Campus, United Kingdom
A multi-functional reconfigurable microwave photonic chip is proposed and theoretically demonstrated. The optical functions obtain continuous adjustability and high operating bandwidth, andcould be realized on the silica-on-silicon platform.

ACPPOEM-0731-106
Passband-Controlled Cascaded Microwave Photonic Filter Based on Refletive Fiber Mach-Zehnder Interferometer
Tao Wu, Qiqi Hu, Enming Xu, Zuxing Zhang
Nanjing University of Posts and Telecommunication, China
An approach to implement passband-controlled cascaded microwave photonic filter (MPF) based on broadband optical source (BOS) and reflective fiber Mach-Zehnder interferometer is proposed and experimentally demonstrated.The sliced

BOS is used as multiple light sources, and a singlemode fiber is used as the dispersion medium. By changing the polarization controllers, the left-passband, right-passband and dual-passband states of the MPF can be separately achieved.The center frequency of the passband can be tuned by changing the optical variable delay line. By cascading a fiber ring, the 3 dB bandwidth of the cascaded MPF can be narrowed, compared to that without cascading the fiber ring.

ACPPOEM-0731-115
Photonic-assisted multifunctional radar for simultaneous measurement of distance, direction and velocity
Yan Li[1], Muguang Wang[1], Yuxiao Guo[1], Jian Wang[1], Bin Yin[2], Beilei Wu[1]
1.Institute of Lightwave Technology, Key Lab of All Optical Network & Advanced Telecommunication Network, Ministry of Education, Beijing Jiaotong University, China; 2.Institute of Marine Technology, Faculty of Information Science and Engineering, Ocean University of China, China
A novel photonic-assisted multifunctional radar is proposed for simultaneous measurement of the distance, velocity, and direction of the target. In this scheme, a dual-polarization binary phase shift keying (DP-BPSK) modulator is used to implement parallel de-chirping process of the echo signals received by two distributed receiving antennas. By applying a composite signal that combines a linear frequency modulated (LFM) signal and a single-frequency microwave signal as the transmitted signal, the distance, velocity, and direction of the target under test can be derived by analyzing the spectra of the de-chirped and beat signals. Simulation experiments are performed to verify the measurement capability and performance of the proposed scheme. The simulation results show that the error of the distance, velocity and direction measurement are less than ± 6×10^{-5} m, ± 0.1 m/s and ± 0.2°, respectively.

ACPPOEM-0731-118
Error vector magnitude optimization in phase-stabilized transmission system for vector signals without precoding
Tao Wang[1], Cheng Gu[1], Shangyuan Li[2], Jinyang Liu[1], Zhengyang Xie[1], Xin Zhao[1], Zheng Zheng[1]
1.Beihang University, China; 2.Tsinghua University, China
This paper investigates the effect of optical signal-to-noise ratio (OSNR) and microwave source amplitude ratio (MSAR) on the error vector magnitude (EVM) of millimeter wave (mm-wave) signals in a dual single-sideband (SSB) signal generation and phase-stabilized transmission system.

ACPPOEM-0731-158
Optoelectronic Oscillator Based on Directly Motulated Microcavity Laser Under Optical Injection
Hang Dong Wei[1,2], Yang Shi[1,2], Yue De Yang[2], Jin Long Xiao[2], Yong Zhen Huang[2]
1.University of Chinese Academy of Sciences, China; 2.Institute of Semiconductors, Chinese Academy of Sciences, China
A tunable optoelectronic oscillator based on a directly modulated diamond-FP coupled cavity microlaser is proposed. Tunable 4.3 to 16.7 GHz signals are experimentally obtained, with a maximum side-mode suppression ratio of 50 dB.

ACPPOEM-0731-166
Multi-point Optical Vector Analyzer Based on Optical LinearFrequency-Modulated Waveform and Kramers-Kronig Receiver
Yaowen Zhang, Lingjie Zhang, Zhen Zeng, Zhiyao Zhang, Yong Liu
UESTC, China
A multi-point OVA is proposed based on optical linear frequency-modulated waveform and Kramers-Kronig receiver is proposed.The Kramers-Kronig receiver is used to suppress spurious signals in the measurement photocurrent, which enhances the measurement accuracy

ACPPOEM-0801-34
Photonic multi-threshold comparator based on Mach-Zehnder modulator
Jinjian Feng, Yang Jiang, Jing Xu, Qiong Zhang, Xiaohong Lan, Qianyou Long, Yunkun Luo
College of Physics, Guizhou University, China
A new photonic approach of multi-threshold comparator based on Mach-Zehnder modulator is proposed and experimentally demonstrated. Unlike previous methods, we avoid the use of electronic comparators. The comparator consists of two modulators, one of which provides a sinusoidal transmission curve and the other modulator based at quadrature point shapes the sinusoidal transmission curve to a square transmission curve. The theoretical analysis and simulation are developed. The comparator stands out for its simple structure, cost-effectiveness, and the flexibility to adjust the threshold. The transmission curve of the comparator exhibits flat tops and bottoms with a relatively steep slope between them, closely resembling the ideal comparator with a fitting degree of 0.82; thus may be used to construct multi-bit analog-to-digital convertors.

ACPPOEM-0801-113
Simplified two-dimensional optical beamforming network based on cascade microring resonators in all-pass filter configuration
Fei Duan[1], Fang Zou[1], Tao Tang[1], Yinghui Guo[2], Xiong Li[2]
1.Tianfu Xinglong lake laboratory, China; 2.The institute of Optics and Electronics, Chinese Academy of Sciences, China
We propose a two-dimensional (2-D) optical beamforming network (OBFN) using cascade microring resonators (MRRs) in all-pass filter configuration. The cascade MRRs can obtain a maximum time delay of greater than 100ps within a radio frequency (RF) range of more than 1.0GHz in 28GHz band. For 4×4 2-D antenna array, the OBFN architecture utilizes only 8 cascade MRRs, and can scan the beam with wide coverage of -60° to 60° in the transverse and longitudinal directions simultaneously.This simplified OBFN architecture is promising to be applied in millimeter-wave communications.

ACPPOEM-0801-142
Automatic Optimization of Electro-Optic Frequency Comb Based on Deep Reinforcement Learning
Zixuan Li[1,2], Shifan Chen[1,2], Yunping Bai[1,2], Yue Zhou[1,2], Xingyuan Xu[1,2], Kun Xu[1,2]
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We propose a novel automatically optimized electro-optic frequency comb (AO-EOFC) based on deep reinforcement learning, which utilizes a deep Q-learning network algorithm to replace blind and inefficient manually optimization in traditional ways.

ACPPOEM-0814-15
Optically Transparent EMI Shielding Film with Excellent Stability Based on Colorless Polyimide and Silver Nanowire
Huang Zhen
Huazhong University of Science and Technology, China
Optically transparent electromagnetic interference (OTEMI) shielding materials have gained significant attention due to their ability to offer both electromagnetic shielding and optical visibility properties. However, existing optically transparent EMI shielding films still exhibit many issues. To meet the practical requirements of both civilian and military applications, OTEMI materials must possess not only high optical transparency and shielding efficiency (SE), but also additional features such as low density, ultra-thin thickness, stability, and reliability in extreme environments. In this study, OTEMI films were embedded with AgNWs using a combination of colorless polyimide and in situ packaging technology with excellent stability. The films exhibit an impressive SE exceeding 4000dB mm^{-1} at a thickness of only 8 um, and their superior shielding properties remain unaffected even after exposure to extreme temperatures of 378K and 161K. The OTEMI films also displayed high transmittance (80%) in the wavelength range of 400-2500nm, with EMI SE exceeding 45 dB in the 12-18 GHz band. Even when folded 1,000 times at a radius of 1.5 mm, the appearance, optical transmittance, and EMI SE of the OTEMI films remained uncompromised. As a result, these films have the potential to be widely used in a wide range of high-temperature and high-pressure work environments that cannot be accessed by humans, offering new opportunities for OTEMI to operate effectively in harsh conditions.

ACPPOEM-0814-73
Measurement of 3.331GHz Pulse Light Signal Using Optical Sampling
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With the advancement of fiber optic communication technology, the measurement of high-speed signals is the guarantee for the future development of fiber optic communication. All optical sampling technology provides a new direction for the measurement of high-speed signals. Linear light sampling with optical hybrid has broad prospects .This article uses a pulse laser with a repetition rate of 30M to mix a 3.331G pulse signal, and the restored pulse signal can reach a similarity of 0.9019 to the initial signal.

ACPPOEM-0815-98
Frequency comb distillation enabling broadband microwave photonic channelized receiver
XiaoLing Zhang[1], Chen Chen[2]
1.Southwest China Institute of Electronic Technology, China; 2.Chongqing University, China
Microwave photonics channelization has become a promising technology for ultra-wideband RF spectral analysis. In this paper, a wideband microwave photonics channelization scheme based on dual optical frequency combs with comb distillation technique is proposed. A 10 GHz bandwidth RF signal with frequencies from 2 to 12 GHz is down-converted to the same IF band with 1-GHz instantaneous bandwidth, where the in-band crosstalk suppression is larger than 33 dB for all channels, and the spurious-free dynamic range of the system can reach 101.3 dB $\cdot Hz^{2/3}$. Moreover, BERs for all channels without and with distillation are compared.

ACPPOEM-0816-2
Frequency-Hopping Signal Measurement Based on Real-time Photonic Fourier Transform
Xin Liu, Dan Zhu, Jiewen Ding, Zhouyang Pan, Tao Lu, Shilong Pan
Nanjing University of Aeronautics and Astronautics, China
A frequency-hopping signal measurement scheme based on real-time photonic Fourier transform is proposed and demonstrated. In the experiment, the wideband and multiple frequency-hopping signals with 100-ns frequency-hopping period and 4-40 GHz frequency range are verified.

Track 6: Photonics for Energy

ACPPOEM-0801-88
Performance of CsPbI3 Photovoltaics for Indoor Light Harvesting
Seon Joong Kim, Jae Won Shim
Korea University, South Korea
With the increasing demand for low-power microelectronic devices in the emerging Internet of Things (IoT) applications, indoor photovoltaics (PVs) have gained significant attention as promising sustainable power generation solutions, especially in dim indoor light conditions. Notably, indoor perovskite photovoltaics (PePV) have been proven to outperform other technologies under indoor lighting conditions. In this study, the potential of $CsPbI_3$-based indoor PePV is explored, evaluating their characteristics under three different indoor light sources: LED, fluorescent lamp (FL), and halogen lamp (HL). The PePVs showcase remarkable power conversion efficiencies (PCE) of 34.0% under LED, 35.5% under FL, and 3.7% under

HL at 1000 lux illumination, accompanied by corresponding output power densities (P_{max}) of 86.5, 107.5, and 174.8 μW/cm^2, respectively. These findings demonstrate the potential suitability of indoor PePV for meeting the power requirements of advanced IoT devices.

ACPPOEM-0807-1
Green-solvent Processable Dopant-free Hole Transporting Materials for Inverted Perovskite Solar Cells
Xinyu Yu, Zhong'an Li
Huazhong University of Science and Technology, China
A star-shaped D-A-D strategy is used to solve the trade-off between green-solvent processing and high hole mobility in dopant-free HTMs. The resulting BTP1 processed by 2-methylanisole achieved an impressive efficiency of 24.34% in inverted PVSCs.

ACPPOEM-0808-5
Efficient Inverted Dopant-free Perovskite Solar Cells with Low Voltage Loss Achieved by a Pyridine-based Polymer Semiconductor
Xianglang Sun
1.Huazhong University of Science and Technology, China; 2.City University of Hong Kong, Hong Kong, China
We report a simple but efficient way to simultaneously reduce the NRR processes inside perovskite and at its interface by rationally designing a new pyridine-based polymer semiconductor.

ACPPOEM-0809-7
Surface termination passivationof imidazole-based diiodide enabling efficient inverted perovskite solar cells
Wang Yu[1], Song Jiaxing[2], Yan Wensheng[1], Li Zaifang[2]
1.Hangzhou Dianzi University, China; 2.Jiaxing University, China
Ligand engineering is an effectivemeans to regulate the chemical environment of the uppersurface of perovskite films. Compared to the ligand engineering realized by moleculeswith electron-donating groups, the ammonium salt-based modificationhas the advantage of a convenient and efficientprocess for the passivation step.We introduced the N-(3-Aminopropyl)-imidazole diiodide (APDI) on the upper surface of FACs perovskite film to modulate the terminal chemical environment. The bifunctionalgroups (C=NH^+-and -NH_3^+-) in APDI make it more effective inreducing the Pb^{2+}defect on the perovskite surface throughbonding to Pb^{2+}. Density functional theory (DFT) demonstratedthat the N on the imidazole ring in APDI was slightly moreinclined to bind to Pb^{2+}traps thantheN on the branched chain.Moreover, the hydrophobicity of the perovskite films wasenhanced by the introduction of APDI with an alkyl chain onthe surface. Consequently, the optimum device with-APDI has an increased PCE, from 20.01% to21.41%. Additionally, the target devices exhibited excellentstability, maintaining 78% and 90% of the initial PCE after800 h and 1000 h of aging in air and nitrogen atmospheres,respectively.

ACPPOEM-0809-9
Lead Sulfide (PbS) Quantum Dots (QDs) Tandem Solar Cells
Salman Ali
WNLO, HUST, China
Lead Sulfide (PbS) Quantum Dots (QDs) possess size-tunable bandgaps (ranging from visible to infrared), solution-processable, stable, and cost-effective. As a result, they hold promise as a material for QDs tandem solar cells. The tandem structure of solar cells presents itself as a promising candidate for surpassing the 31% Shockley–Queisser limit of single-junction solar cells. The first exploration of a tandem structure for PbS QDs solar cells dates back to 2011. However, progress has been gradual, and the most notable achievement for the tandem structure in 2017 was an efficiency of 9%. This lags behind the 11% efficiency attained by single-junction QDs solar cells. In this study, we introduce a tandem solar cell utilizing solution-processible PbS Quantum Dots (QDs) with distinct bandgaps: PbS 1.33 eV in the top cell and PbS 0.92 eV in the bottom cell. To facilitate charge generation, we replaced the PbS QDs's ligands with iodine (I) and bromine (Br), which serve as the charge generation layers in the respective subcells. For interconnection, we employed an ultra-thin gold film. Due to the bottom cell's heat and solvent exposure, we implemented a protective layer of SnO_2 to shield the top cell. Our tandem solar cell architecture, denoted as ITO/ZnO (100 nm)/PbS (1.33 eV 200 mg/ml)/PbS-Edt/Au (1 nm)-SnO_2 (15 nm)/ZnO (50 nm)/PbS (0.96 eV 350 mg/ml)/PbS-Edt/Au, achieved a noteworthy efficiency of 5.8%. However, further investigation is needed to identify a recombination layer with minimal resistance. The deposition techniques employed include sputtering for the Electron Transport Layer (ETL), spin coating for the absorber and Hole Transport Layer (HTL), electron beam evaporation (e-beam) for the interconnection layer, and Atomic Layer Deposition (ALD) for the SnO_2 protective layer. The stability, excellent performance, and low-temperature processing could offer the potential future commercialization of flexible and large-area tandem solar cells utilizing quantum dots (QDs).

ACPPOEM-0810-1
Interface Interactions and Inhibition Strategies in Non-Fullerene Organic Solar Cells
Lin Hu
Jiaxing University, China
The development of novel non-fullerene acceptors and their matched donors have driven the rapid advancement of organic solar cells. Currently, the power conversion efficiency (PCE) of organic solar cells has exceeded 20%, demonstrating promising application prospects. Long-term stability has become a key factor for the application of this photovoltaic technology. Interface engineering is one of the most important issues contributing the state-of-the-art OSCs to obtain superior PCE and stability. In this work, the chemical reaction between the fused-ring electron acceptors and commonly used cathode interface modification layer polyethyleneimine (PEI) is systematically investigated. The interaction sites and reaction mechanisms are confirmed through mass spectrometry, nuclear magnetic resonance spectroscopy, absorption spectroscopy, and infrared spectroscopy analysis. The strategies of protonation of PEI and the formation of a phenol self-assembled layer ontop of PEI surface are employed to inhibit this adverse chemical reaction. Furthermore, a novel PEIE-Pac is designed to

passivate the surface defects of ZnO electron transfer layer. The interface photocatalytic reaction is suppressed and the device stability under air and light conditions are enhanced. The aforementioned investigations contribute to a deeper understanding of the interface degradation processes and mechanisms in non-fullerene organic solar cells.

ACPPOEM-0810-3
High performance PEDOT/PPy composites for electrochemical supercapacitor
Yingzhi Jin
Jiaxing University, China
The conductive polymer is a promising candidate for energy storage devices due of its flexibility, light weight, and low cost. Poly (3,4-ethyldioxythiophene) (PEDOT) electrode with good conductivity and stability is successfully fabricated by in-situ chemical polymerization. Using the PEDOT electrode as the substrate, a binder-free PEDOT/ (polypyrrole) PPy composite electrode is further produced by electrochemically polymerizing PPy on the top surface of PEDOT. Compared to the PPy electrode, the electrochemical performance and stability of PEDOT/PPy have been greatly improved. At a current density of 2 A/cm^3, a high capacitance of 764 F/cm^3 is obtained, and the capacitance retention rate of 74.6% can be obtained after 3,000 cycles at a current density of 48 A/cm^3. This study provides a new route for the preparation of high electrochemical performance conductive polymer composite electrodes.

ACPPOEM-0810-9
Tuning the Length of Carbosilane Side Chains in the Non-fullerene Acceptors for Highly Efficient and Mechanically-Robust Organic Solar Cells
Di Zhang
Huazhong University of Science and Technology, China
Emerging wearable electronics and sensor devices for internet-of-thing (IoT) systems would benefit from integration of low-cost light-harvesting power sourcessuch as organic solar cells (OSCs). Although the state-of-art OSCs have achieved power conversion efficiencies (PCEs) surpassing 19%, they fail operation under large mechanical deformation (ultimate tensional strain, e_u, 10%). Here, we have synthesized three small molecule acceptors (SMAs) based Y-series and attached the different length of the carbosilanes group to the pyrrole unit named BTP-SiX (X = 4, 6, 8) for OSCs designed for large mechanical compliance. The farther the branching points of SMAs are from the fused core, the higher the e_u of PM6:BTP-SiX blend films are. The PM6:BTP-Si6 blend film achieves a record eu of 30.5%, nearly six-fold higher than the widely used PM6:Y6 reference blend (e_u ~ 4.5%). Especially, the mechanical properties of blend films also remarkably displayed a higher than the e_u of pristine films (e_u ~ 23.7%). Morphological and structural analysis demonstrate that BTP-SiX crystallizes to a less extent and is highly miscibile with PM6, leading to the significantly improved mechanical stretchability. Most importantly, the enhanced blend stretchability does not sacrifice the device efficiency with PM6:BTP-Si6 blend based OSCs exhibiting a PCE of 16.4%. To the best of our knowledge, it is the highest e_u achieved in high efficiency OSCs. Indeed, we demonstrate that our OSCs operate normally under stretching deformations restraining > 81% of the initial PCE under a e_u of 30%. The structure-property relationship study proves that side chain engineering based on carbosilanes side-chains is a promising design strategy to develop highly efficient and mechanically robust OSCs appropriate for stretchable electronics.

ACPPOEM-0811-6
Efficient and Stable2D Perovskite Solar Cells
Tong Bie
Huazhong University of Science and Technology, China
The2D PSCs achieve a record PCE of 21.07% , which is the highest efficiency reported to date. Importantly, thePSCs retain 97% of their initial efficiency at 85°C persistent heating after 1500h.

ACPPOEM-0812-8
Amine-Free ZnO Precursor to Suppress Dedoping of PEDOT Electrodes for All-Solution-Processed Flexible Organic Solar Cells
Jianping Chen, Yinhua Zhou
Huazhong University of science and technology, China
Poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) is a widely used solution-processed electrode in organic solar cells with the advantages of high electrical conductivity and high optical transparency. Highly oxidized (doped) states are the origin of its high electrical conductivity. However, PEDOT can be readily dedoped by reductive reagents, such as amines. Traditional sol-gel ZnO precursors (including ethanolamine and zinc acetate in 2-methoxyethanol denoted as ZnO_{EA}) cause dedoping when deposited on top of PEDOT to produce low work function for electron collection. In this work, we report that an amine-free precursor of ZnO (zinc acetate dehydrate in methanol denoted as $(ZnO)_{EA\text{-}free}$) is introduced to replace traditional ZnO precursors, which can suppress the chemical dedoping of PEDOT:PSS films. PEDOT:PSS remains higher optical transmittance and electrical conductivity after coating $(ZnO)_{EA\text{-}free}$than ZnO_{EA}films. All-solution-processed flexible devices with the device structure of PET/PEDOT:PSS/$(ZnO)_{EA\text{-}free}$/PEI/PM6:L8-BO/PEDOT:F/PEDOT:PSS show a power conversion efficiency of 11.9% with an open-circuit voltage of 0.87 V, a short-circuit current of 20.8 mA cm^{-2}, and a fill factor of 0.66.

ACPPOEM-0812-9
Understanding the composition of layer-by-layer deposited active layer at buried bottom surface
Kai Feng, Zhou Yinhua
Huazhong University of Science and Technology, China
Layer-by-layer (LbL) coating is becoming a widely used method to fabricate nonfullerene active layer films for organic solar cells. However, the vertical compositional distribution of the LbL-coated active layer, particularly at the buried bottom surface, is not clear yet. In common sense, it is believed that the LbL-coating yields a donor-mixture-acceptor (D-m-A) vertical distribution in the active layer, i.e., a thin polymer donor layer at the bottom surface, a thin acceptor layer at the top surface and a donor-acceptor mixture in the middle. In this work, we show that the LbL active layer vertically is an entire donor:ac-

ceptor mixture. A pure layer of polymer donor didn't exist at the bottom surface. The LbL active layer delivered high performance in both conventional and inverted device structures. A thin polymer layer with different thicknesses (2, 6, 12 nm) was inserted at the bottom surface to study their effects on the device performance. Those inserted layers substantially deteriorated the device's performance. Furthermore, the assumption was further confirmed by X-ray photoelectron spectroscopy measurement on the exposed "originally buried" surface. This study sheds light on understanding the vertical compositional distribution of active layer via layer-by-layer solution processing.

ACPPOEM-0814-9
Realistic losses of indoor organic and perovskite photovoltaics
Xinlu Liu, Yinhua Zhou
Huazhong University of Science and Technology, China
The application in indoor light is one of the significant development directions of organic and perovskite photovoltaics. In 1961, Shockley and Queisser reported that the detailed balance limit of efficiency in standard sunlight was about 33%. However, realistic losses of the organic and perovskite PVs under indoor illumination are to be understood for further efficiency improvement. Based on the detailed balance limit of efficiency, we calculated the limit efficiency of the photovoltaics to be 55.33% whose band gap (E_g) of active layer is 1.8 eV in LED with an illumination of 1000 lux and a spectral color temperature of 2700 K. In practice, the loss of external quantum efficiency (EQE_{PV}), non-radiative recombination, and resistance within the devices would all cause further losses. For organic or perovskite solar cells in the LED with a color temperature of 2700 K and an illumination of 1000 lux, when EQE_{PV} = 0.9, EQE_{EL} = 0.1, R_s = 0.5 Ω cm^2 and R_{sh} = 104 kΩ·cm^2, the highest efficiency of 47.39% can be obtained at the band gap of the active layer of 1.77 eV.

ACPPOEM-0814-11
Two-in-one alcohol-processed PEDOT electrodes produced by solvent exchange for organic solar cells
Xianmin Zhou, Xinyun Dong, Yinhua Zhou
Huazhong University of Science and Technology, China
Poly(3,4-ethylenedioxythiophere):poly(styrenesulfonate) (PEDOT:PSS) is a common solution-processed electrode for printable organic solar cells. However, the water-dispersed PEDOT:PSS displays de-wetting issues when deposited on active layer, which limits its application on printable top electrode. In this work, we report a solvent exchange method to prepare alcohol-processed PEDOT:PSS. Spontaneous exchange of water and alcohol occurs when aqueous PEDOT:PSS in membrane is immersed into alcohol. This is probably due to the polarity difference that induces different speed to pass through the dialysis membrane. The PEDOT:PSS residual was further dispersed in ethanol and ethanol-based PEDOT:PSS (e-PEDOT:PSS) was obtained. The e-PEDOT:PSS has good wetting ability and high electronic conductivity. Work function of e-PEDOT:PSS was tuned from 4.9 to 5.3 eV by adding alcohol-based fluorinated formulation (PEDOT:F). The obtained formulation e-PEDOT:PSS was blade coated as the top electrode without additional hole-transporting layers (called 2-in-1 electrode), and the fabricated devices based on e-PEDOT:PSS showed an efficiency of 14.02%.Poly(3,4-ethylenedioxythiophere):poly(styrenesulfonate) (PEDOT:PSS) is a common solution-processed electrode for printable organic solar cells. However, the water-dispersed PEDOT:PSS displays de-wetting issues when deposited on active layer, which limits its application on printable top electrode. In this work, we report a solvent exchange method to prepare alcohol-processed PEDOT:PSS. Spontaneous exchange of water and alcohol occurs when aqueous PEDOT:PSS in membrane is immersed into alcohol. This is probably due to the polarity difference that induces different speed to pass through the dialysis membrane. The PEDOT:PSS residual was further dispersed in ethanol and ethanol-based PEDOT:PSS (e-PEDOT:PSS) was obtained. The e-PEDOT:PSS has good wetting ability and high electronic conductivity. Work function of e-PEDOT:PSS was tuned from 4.9 to 5.3 eV by adding alcohol-based fluorinated formulation (PEDOT:F). The obtained formulation e-PEDOT:PSS was blade coated as the top electrode without additional hole-transporting layers (called 2-in-1 electrode), and the fabricated devices based on e-PEDOT:PSS showed an efficiency of 14.02%.

ACPPOEM-0814-30
Antioxidant strategy based on Lewis acid-base theory in tin-leadperovskitesolar cells
Tianjun Ma
Huazhong university of science and technology, China
Tin-leadperovskites are particularly attractive for photovoltaic applications because their bandgap is tunable in the range of 1.2–1.6 eV, whicharereally appropriate for optimum single-cell efficiencies and bottom cells in all-perovskite tandem devices.Though mixed Sn-PbPSCs have made huge progress recently, it still has low power conversion efficiency (PCEs) compared to Pb-based PSCs.Besides relative low efficiency, poor long-term stability is also a serious problem for Sn-Pb PSCs in practical applications, which the oxidation of $Sn^{2+}$to $Sn^{4+}$is still the main cause. There are many ways to inhibit Sn^{2+}, including deoxygenating the material, adding reducing agents to the precursor solution, or complexing antioxidants with Sn^{2+} to inhibit its oxidation.

ACPPOEM-0814-44
Encapsulation of flexible organic solar cells
Hui Zheng, Yinhua Zhou
Huazhong University of Science and Technology, China
Flexible organic solar cells (OSCs) have a susceptibility to water vapor and oxygen which limit thier commercial application. In order to improve the stability of OSCs, encapsulation is indispensable. In this study, it is reported that a strategy of alternating barrier films with parylene and alumina dyads, in which organic parylene layers are deposited by chemical vapor deposition (CVD) and dense alumina films are grown by atomic layer deposition (ALD). Using a method of the resistance change of patterned calcium films to calculate water vapor transmission rates (WVTR). Three dyads film shows an extremly low WVTR of 8.7×10^{-4} g m^{-2} day^{-1} (25 °C/99% RH). These encapsulated OSCs show excellent stability under constant illumination and in water.

ACPPOEM-0814-49
An ionic liquid additive for High-Quality Narrow Bandgap Sn-Pb Perovskites and Efficient All-Perovskite Tandem Solar Cells
Ranran Liu
Wuhan National Laboratory for Optoelectronics, China
The narrow bandgap of tin-lead halide perovskite is appropriate for the bottom cell of all-perovskite tandem solar cells. However, due to the oxidation propensity and high Lewis acidity of Sn^{2+}, Sn-based perovskite films have rapid crystallization process and high defect density, leading to poor film quality and notorious device instability. In this work, we synthesize an ionic liquid additive, which contains sulfonate anion and ammonium cation. The sulfonate anion in the ionic liquid additive can passivate uncoordinated Sn^{2+}/ Pb^{2+}defects and retard the oxidation of Sn^{2+} by chelate coordination, enabling the growth of high-quality Sn-Pb perovskite. As a result, the ionic liquid-processed tin-lead halide perovskite devices exhibit a remarkable efficiency of 22.25% with remarkable enhancement in both open-circuit voltage and fill factor. Benefitting from high quality film, the sub-cell of 1.75eV is integrated into a tandem device, yielding a 25.5%-efficient all-perovskite monolithic tandem device.

ACPPOEM-0815-13
Mechanical Properties Optimizations of Ultra-flexible organic solar cells
Fei Qin
Northwestern University, China
Ultra-flexible organic solar cells (OSCs) exhibit great potential as a promising power source for electronic skin and wearable electronic systems. To increase the mechanical properties of ultra-flexible OSCs, every layer in the device should be improved. Here, electron transport layer (ETL) and the active layer are investigatedto enhance the flexibility of the whole device, respectively. Ametal ion-chelated polymer interfacial layer (PEI-Zn), which can bechemically compatible with different non-fullerene active layers and possess excellent flexibility,was developed. The ultra-flexible OSCs with a thickness of less than 5 um demonstrate a PCE of 15% and stable performance undercontinuous compression-flat deformation. As for the active layer, two polymer acceptors (PAs) with fully and non-fully conjugated structures were synthesized. The nonconjugatedPA revealssuperiormechanical ductility compared to the conjugated one. The nonconjugated PA-based ultra-flexible OSCs also demonstrate the best mechanical stability. Upon the optimization of ETLs and the active layers, we realized the high-efficient ultra-flexible OSCs with excellent stability under large strain, demonstrating promising application in wearable electronics.

Track 7: Micro-, Nano-, and Quantum Photonics: Science and Applications

ACPPOEM-0723-2
A broadband double-lined metasurface for Simultaneous Generation of inverse functions
Zongkun Zhang, Mingzhe Chong, Jin Zhao, Yueyi Zhang, Pu-kun Liu
Peking University, China
This paper explores one new plasmonic function that displays inverse functions on the two sides using columns of nonoslits, which is applicable in broadband wavelength range. The design strategy is well verified in two terahertz structures.

ACPPOEM-0725-6
Graphene-Quantum-Dots-Graphene Heterojunction Waveguide Photodetector with Low dark current and High Speed
Laiwen Yu[1], Jingshu Guo[1], Xuezhi Zhao[2], Hengtai Xiang[1], Liang Gao[2], Daoxin Dai[1]
1.Zhejiang University, China; 2.Huazhong University of Science and Technology, China
We demonstrate a graphene-QDs-graphene heterojunction photodetector. The measured bandwidth is ~2 MHz at 1550 nm, and the high NPDRof ~8×10^5 W^{-1} are obtained with the low dark current of 1.1 pA at a bias of 1 V.

ACPPOEM-0731-2
Low Loss Asymmetric Bragg Grating Mode Couplers on Thin Film Lithium Niobate for Efficient Extraction of Reflected Light
Lars Emil Gutt[1], Thach Nguyen[2], Peter Girouard[1], Guanghui Ren[2], Leif Katsuo Oxenløwe[1], Bill Corcoran[3], Arnan Mitchell[2], Pengyu Guan[4]
1.DTU, Denmark; 2.RMIT, Australia; 3.Monash University, Australia; 4.Beijing Institute of Technology, China
Bragg gratings are important components in integrated photonics, however, efficiently accessing the reflected waves remains challenging. Here, we demonstrate an asymmetric Bragg grating mode coupler in thin-film lithium niobate with -0.95 dB insertion loss.

ACPPOEM-0731-181
Impact of Non-Vertical Sidewalls on Bandgap Characteristics of LiNbO3 Photonic Crystals
Peyman Bagheri, Xiaoyan Zhou, Lin Zhang
Tianjin University, China
We investigated the impact of non-vertical sidewall angles on TFLN PhCs. A typical slanted sidewall in PhCs reduce the gap-midgap ratio by 50%. We propose compensative solutions and provide design guidelines for TFLN photonic circuits.

ACPPOEM-0801-17
High-Performance Thermo-Optic Switch Based on Graphene Microheater and Fano Slab Photonic Crystal Cavity
Xiaoyan Gao, Yilun Wang, Wentao Gu, Wenchan Dong, Xinliang Zhang
Wuhan National Laboratory for Optoelectronics, China
A high-performance thermo-optic switch based on fano slab photonic crystal cavity and graphene microheater is pro-

posed, with a thermal tuning efficiency of 0.548nm/mW and a rise/decay time of 11ns/9ns validated in simulation.

ACPPOEM-0801-44
Ultra-low-loss Silicon Waveguides covering a very large band
Gangmin Li, Shihan Hong, Long Zhang, Zixu Xu, Daoxin Dai
Zhejiang University, China
We present an ultra-low-loss silicon waveguide covering a very large band. Additionally, we investigate the waveguide wavelength-dependent scattering losses. Remarkably, we achieve loss reductions of (0.1663, 0.1226, 0.0742) dB/cm around (1310, 1550, 1910) nm, respectively.

ACPPOEM-0801-85
SNR improvement in differential reflection method for weak absorption measurement
Zhen Wang[1], Shipeng Yao[2], Jinghao Wang[1], Chen Hu[1], Huan Zhang[1], Hao Sun[2], Kun Yin[1], Cun-Zheng Ning[3]
1.Zhejiang Lab, China; 2.Tsinghua University, China; 3.Shenzhen Technology University, China
The impact of the dielectric environment on SNR within the differential reflection method for weak absorption measurement was investigated.Signal of sampleencapsulated in metal and high-refractive-index material exhibited one-order enhancement compared to transparency substrate.

ACPPOEM-0801-106
Characterization of Two-Dimensional Microwave field Beyond the Diffraction Limit
Longkun Shan, Tongtian Weng, Wang Zehao, Mengqi Ma, Shaochun Zhang, Xiangdong Chen, Fangwen Sun
University of Science and Technology of China, China
In nanoelectronics research, microwaves have attracted considerable attention due to it's widespread application in the semiconductor industry.Quantum sensing imaging such as the NV Center provides an efficient way to directly measure microwaves at the nanoscale. However, the diffraction limit, a fundamental limitation in microscopy imaging, prevents us from exploiting the potential advantage of quantum sensing in this field. Here, we use structured illumination microscopy (SIM), a popular superresolution technique, to overcome this challenge. To the best of our knowledge, this is the first time that a wide-field superresolution scheme has been implemented in optically based nanoscale microwave measurements. To demonstrate our method in a real-world quantum sensing experiment, we perform SIM-based microwave imaging of nanowire networks using NV centers. We observe a twofold improvement in resolution compared to wide-field imaging. Such a valid result illustrates the potential of our approach, especially for further applicationsin the field of microwave phtonics.

ACPPOEM-0801-152
Hybrid Coupler for Examining Indistinguishability between Surface Plasmon Polariton and Photon
Ruoyun Luo[1], Boyu Fan[1], Yaoqing Zhang[1], Yuanxia Qi[1], Yunru Fan[1], Guangwei Deng[1], Haizhi Song[1,2], You Wang[1,2], Guangcan Guo[1,3], Qiang Zhou[1,3]
1.University of Electronic Science and Technology of China, China; 2.Southwest Institute of Technical Physics Institute of Fundamental and Frontier Sciences, China; 3.University of Science and Technology of China, China
We present a hybrid coupler for examining indistinguishability between surface plasmon polariton (SPP) and photon. Our results show that the obtained hybrid coupler chip satisfies the requirement for investigating the property of SPP.

ACPPOEM-0803-4
Super Quasibound State in the Continuum
Zhanyuan Zhang[1,2], Yi Xu[1,2], Yuwen Qin[1,2,3]
1.Key Laboratory of Photonic technology for Integrated Sensing and Communication, Ministry of Education, China; 2.Guangdong Provincial Key Laboratory of Information Photonics Technology, Institute of Advanced Photonics Technology, School of Information Engineering, Guangdong University of Technology, China; 3.Southern Marine Science and Engineering Guangdong Laboratory, China
Avoided crossing of resonances and merging multiple bound states in the continuum (BICs) are parallel means for tailoring the physical properties of BICs. Herein, we introduce a new concept of super quasi-BIC for photonic crystal PhC systems where its quality (Q) factor is boosted in both parametric and momentum spaces. A super quasi-BIC with substantial enhancement of Q factor can be achieved in a finite PhC by combining avoiding crossing of two symmetry protected (SP) quasi-BICs in parametric space and merging BICs in momentum space simultaneously. More importantly, analytical theory shows that the proposed mechanism results in the transition of asymptotic behavior of the Q factor over the numbers of resonators from N^2 to exclusive N^3 for SP-BICs, which is of vital importance for realizing quasi-BICs in a compact PhC. Microwave experiments are performed to validate the theoretical results. Our results provide a paradigm shift for manipulating the physicalproperties of quasi-BICs in finite PhC structures, which would facilitate various applications, including but not limited to low threshold lasing, wireless power transfer and high figure of merit sensing etc.

ACPPOEM-0815-115
Digital-Based Inverse Design for Ultra-Compact Power Splitter on LNOI
Lingjun Zhou[1,2], Hansi Ma[3], Xiaomin Nie[1], Yunchen Li[1,2], Zhixue He[1], Lei Wang[1], Ke Li[1], Fan Zhang[1,2]
1.Peng Cheng Laboratory, China; 2.Peking University, China; 3.National University of Defense Technology, China
We propose and experimentally demonstrate an ultra-compact and efficient power splitter on LNOI. The device is realized through the inverse design of a digital meta-structure and occupies a small footprint of only 4.8×4.8μm^2. The measured results show that the insertion losses are below 2.5dB across the wavelength band of 1500-1560 nm, and the power imbalance between the two output ports is within 0.3 dB.

Track 8: Photonic Sensors & Bio-Photonics

ACPPOEM-0707-1
Photo-responsive chemistry in the diagnosis and treatment ofmitochondrial diseases
Bo Peng[1],Lin Li[2], Hua Bai[1]
1.Northwestern Polytechnical University, China; 2.Xiamen University, China
Stimulus-responsive chemistry is a kind of chemical reactions that only occur in the presence of target molecule or chemical environment. Due to its specificity, stimulus-responsive chemistry has been used in various biological applications, such as controlled drug release, hydrogel, disease diagnosisetc.By using stimulus responsive chemical groups, we synthesized a series of molecules, which are sensitive to different stimuli, such as light, pH and enzymes. Based on these molecules, several mitochondria-related biomedical applications have been designed and studied, such as organ-on-a-chip, mitochondrial protein detection, mitochondria extraction, drug delivery and mitochondria imaging.

ACPPOEM-0710-1
Temperature-independent integrated optical sensor based on a Fabry-Perot cavity using the slot hybrid-core waveguide
Zhaoyang Chen[1], Yanqing Qiu[1], Tingting Lang[2], Xiaowei Guan[3]
1.China jiliang University, China; 2.Zhejiang University of Science & Technology, China; 3.Jiaxing Research Institute Zhejiang University, China
We propose a novel temperature-independent integrated optical sensor, which consists of Bragg gratings andslot hybrid-core waveguide.The proposed sensor can achieve low temperature dependence within 1pm/K while sustain a high sensitivity of 278 nm/RIU.

ACPPOEM-0725-4
Tilted Fibre Bragg Grating for Rapid Clinical Detection of Platinum Ion
Yifan Duan[1], Dongyang Du[1], You Lv[1], Yunting Du[2], Ji Shi[2], Xiaojing Tong[2], Qiao Wang[1], Yang Zhang[1], Wei Peng[1]
1.Dalian University of Technology, China; 2.Cancer Hospital of Dalian University of Technology (Liaoning Cancer Hospital & Institute), China
In this paper, we have developed a highly sensitive and practical sensor for platinum ions, which holds significant promise for clinical cancer diagnosis and pharmaceutical development. The sensor utilizes tilted fiber Bragg grating surface plasmon resonance as its core sensing technology, integrating it with DNA-targeted biomolecule probes to enable precise target-specific capture. By detecting various concentrations of platinum ions, we have successfully demonstrated that the sensor's detection range and minimum detection concentration adequately meet the requirements for clinical platinum ion detection, offering an effective technical solution for implementing long-term point-of-care testing of platinum drugs.

ACPPOEM-0725-7
Optical magnetic field enhancement by strong coupling for high sensitivity sensing
Huimin Wang, Tao Wang
Huazhong University of Science and Technology, China
We investigate the strong couplingbetween propagating surface plasmon polariton and magnetic plasmon resonance.The enhanced magnetic field intensity and sensitivity of the proposed structure are up to 550 times and 585 nm/RIU, respectively.

ACPPOEM-0727-4
Raman Gas Sensor Based on Platinum Coated Capillary
Zhixiong Liu, Qilu Nie, Mengen Cheng, Dexun Yang, Minghong Yang, Donglai Guo
Wuhan University of Technology, China
A multi-component gas Raman spectroscopy sensor based on platinum-plated capillary with probe structure for easy arrangement and practicaldetection capability for low concentration gases with potential for industrial applications.

ACPPOEM-0727-6
Investigation on the Coexistence of Real-time DAS System and High-speed Coherent Optical Signal
Yiqi Li, Hu Shi, Yan Zhao, Zhongshu Zhang, Mo Zhu, Zhanshan Wang
ZTE Corporation, China
The phase optical time-domain reflectometry based onchirped pulses is demonstrated. The real-time systemhas realized a sensing distance of over 60km. The coexistence experiment with high-speed coherent optical signals reveals the performance of co/counter-propagation.

ACPPOEM-0728-12
High numerical aperture piezopolymer detectors for optoacoustic imaging of experimental neoplasms
Alexey Kurnikov[1], Grigory Volkov[1], Anna Orlova[1], Andrey Kovalchuk[1], Yulia Khochenkova[1], Daniel Razansky[2,3], Pavel Subochev[4]
1.Institute of Applied Physics, Russian Academy of Sciences, Russia; 2.Institute of Pharmacology and Toxicology, Faculty of Medicine, University Zurich, Switzerland; 3.Institute for Biomedical Engineering, Department of Information Technology and Electrical Engineering, ETH Zurich, Switzerland; 4.Institute of Applied Physics, Russian Academy of Sciences, Russia
A number of optoacoustic (or photoacoustic) microscopy and mesoscopy techniques have successfully been employed for non-invasive tumor angiography. However, accurate rendering of tortuous and multidirectional neoplastic vessels is commonly hindered by the limited angular coverage of commercially available ultrasound transducers. In this work, it is theoretically and experimentally shown that a wide viewing angle allows obtaining more detailed and continuous images of the of the intricate arbitrarily-oriented neovasculature in experimental tumors. To reduce the effect of a limited field of view, a detector based on a PVDF piezopolymer film was developed, which has an ultra-high numerical aperture of 0.9, an aperture

diameter of 27 mm, suitable for imaging tumors of various sizes.

ACPPOEM-0728-25
Deep-Learning-based Simultaneous Demodulation and Denoising for Φ-OTDR
Yongxin Liang, Jialei Zhang, Shibo Zhang, Zhenyu Ye, Anchi Wan, Chunye Liu, Jianhui Sun, Zinan Wang
University of Electronic Science and Technology of China, China
A deep learning model was proposed to simultaneously integrate the functions of demodulation and denoising for the phase-sensitive optical time domain reflectometry (Φ-OTDR), resulting in low-noise reconstruction of the phase curves.

ACPPOEM-0728-32
Experimental research of angiographic capabilities of photoacoustic probe based on gradient lens and PVDF-TrFe ultrasonic detector
Daria Voytovich, Alexey Kurnikov, Anna Orlova, Pavel Subochev
Institute of Applied Physics, Russian Academy of Sciences, Russia
Optical resolution photoacoustic microscopy (OR-PAM) is an in vivo imaging technique with micrometer spatial resolution. The paper presents the OR-PAM setup that uses copolymer PVDF-TrFe film as a piezo element in ultrasonic detector. PVDF-TrFe film allows to increase a sensitivity of piezoelectric detector. Experimental capabilities of OR-PAM probe based on GRIN-lens and the copolymer ultrasonic antenna is described in the paper.

ACPPOEM-0729-18
Utilizing Two-Dimensional Perovskite in a TFBG Humidity Sensor for Improved Soil Moisture Detection
Wang Xiaoniu[1], gao Feng[1], Yang Yi[2], Shen Changyu[1]
1.China Jiliang University, China; 2.Fujian Normal University, China
This study proposes a reflective, TFBG based soil content sensor enabled by a two-dimensional halide perovskite material $(PMA)_2PbBr_4$). The sensor exhibits a linear response when the soil moisture content ranging from 0% to 16.67%, and the sensitivity of the soil water content is observed to be 0.43 dB/%.

ACPPOEM-0731-24
High Accuracy Curve Reconstruction based on Twisted Multicore Fiber and Twist bias Calibration
Yang Keyuan[1,2], Gui Zhiyuan[1,2], Ke Changjian[1,2], Xu Zikang[1,2], Liu Deming[1,2]
1.School of Optical and Electronic Information, Huazhong University of Science and Technology, China; 2.National Engineering Research Center of Next Generation Internet Access-system, Huazhong University of Science and Technology, China
A high accuracy curve reconstruction method based on twisted multicore fiber and twisted bias calibration is proposed. The reconstruction error is optimized from 7.43 mm to 1.41 mm after twist bias calibration.

ACPPOEM-0731-29
Quasi-Distributed Relative Humidity Sensing Based on Optical FMCW Multiplexed Fabry-Perot Interferometer
Zhiyu Feng[1], Chaotan Sima[1], Yu Cheng[2], Yi Tang[2], Zhipeng Wang[2], Yu Pan[2], Libo Yuan[2]
1.Huazhong University of Science and Technology, China; 2.Guilin University of Electronic Technology, China
A quasi-distributed fiber optic relative humidity sensing system based on optical frequency modulated conti-nuous wave (FMCW) multiplexing Fabry-Perot interferometer (FPI) is proposed. In this paper, the fundamental structure and the locating principle are introduced, and the system layout and signal demodulation process are described in detail. Next, the sensing performance of the system is evaluated through humidity experiments. Finally, the stability of the system is tested by repeatability experiments. The system can be used for online monitoring of environmental humidity status and has significant application prospects for quasi-distributed sensing based on FPI.

ACPPOEM-0731-168
Novel Dual-Axis Accelerometer Designs Using Cavity Optomechanics: Analysis and Simulation
Chuanwang Fang, Jiahui Liang, Zijiang Liao, Jing He, Ruoyu Li, Yongjun Huang
University of Electronic Science and Technology of China, China
This paper presents novel dual-axis accelerometers using cavity optomechanics, optimized through theoretical analysis and COMSOL simulations. Highlighted improvements include reduced thermal noise, paving the way for high-precision, cost-effective applications.

ACPPOEM-0731-173
Innovative Fusion of Multimode Fiber and Multicore Fiber for High-precision Non-contact Displacement Measurement
Zheng Gao, Ting Jiang, Jing Liu, Huan He, Fengming Zhang, Ming Tang
Huazhong University of Science and Technology, China
We demonstrated a non-contact displacement measurement system based on multimode fiber (MMF) and multicore fiber (MCF). The proposed MMF-MCF structure converts the displacement into variations in pulse intensity and break the speed limitations of conventional camera-based methods. The mean absolute error (MAE) for displacement estimation is 2.3 μm, with the estimation range of 300 μm.

ACPPOEM-0731-185
Investigation of a Subwavelength Grating Bimodal Interferometric Sensor Built on Silicon Nitride Platform
Wenyu Liao, Yiqiang Chen, Linghua Wang
Fuzhou University, China
A bimodal interference sensor on a 400nm-thick silicon nitride (SiN) platform is proposed, using a subwavelength grating (SWG) waveguide structure. The device has good sensitivity and is easy to be fabricated with accessed commercial foundry.

ACPPOEM-0801-42
A wearable strain sensor based on mechanoluminescent polydimethylsiloxane fiber
Tang Mengjing, Jiang Qinchuan, Luo Ling, Xu Jing, Chen Qingming
School of Microelectronics Science and Technology, Sun Yat-Sen University, China
This paper presents a ZnS:Cu-added polydimethylsiloxane fiber as a mechanoluminescent wearable sensor. Both the strength and frequency of the finger bending have been detected by this sensor. It will find applications in low-cost wearable sensor.

ACPPOEM-0801-141
Statistics for Intensity of Rayleigh Backscattering based Coherent Distributed Measurement System
RenYan, XieWeilin, TanZhongwei, WeiWei, DongYi
Beijing Institute of Technology, China
A modified analytical method for calculation of the statistics of intensity of Rayleigh backscattering of non-ideal light source is presented. The probability density function is deduced and its evolution in different system states are exhibited.

ACPPOEM-0804-1
Asensitive relative humiditysensor based on a tapered fiber Mach-Zehnder interferometer coated with hydrogel
Lingchao Bai, Yuanji Fan, Guiyu Wang, WuYao, Xuefeng Chen, Xiujuan Yu
Heilongjiang University, China
This paper presents a novel and compact relative humidity sensorbased on a taperedfiber Mach-Zehnder interferometer coated with hydrogel.The proposedsensor has a humidity sensitivity of 0.466nm/%RH within humidityrange of 80-98 %RH.

ACPPOEM-0809-3
A Robust Vessel Labeling Pipeline with High Tissue Clearing Compatibility for 3D Mapping of Vascular Networks
Yating Deng, Jingtan Zhu, Xiaomei Liu, Tingting Yu, Dan Zhu
Huazhong University of Science and Technology, China
The combination of vessel-labeling, tissue-clearing, and light-sheet imaging techniques provides a potent tool for accurately mapping vascular networks across different tissue types, enabling the assessment of vascular remodeling in vascular-related disorders. However, most vascular labeling methods face challenges due to fluorescence quenching after extended periods of tissue-clearing, which significantly undermines the image quality. To address this limitation, we introduce a vessel-labeling pipeline, termed Ultralabel. Ultralabel employs dextran dye covalently bound to lysine residues, mixed with a gelatin solution to fill blood vessels and subsequently strengthened by aldehyde fixation. Consequently, Ultralabel demonstrates high compatibility with all the tissue clearing methods tested and outperforms other vessel labeling methods, enabling successful 3D reconstructions of the vascular networks in the mouse brain, liver, and spinal cord. In conclusion, Ultralabel tackles the issue of reduced fluorescent signals and enhances tissue clearing compatibility, making it a robust and user-friendly method for obtaining precise structures of 3D vascular networks. This promising technique is expected to be a valuable tool for the precise analysis of vascular dysfunction and diseases.

ACPPOEM-0809-8
Photobiomodulation of brain waste removal system.
Elmira Kaibeleva, Oxana Semyachkina-Glushkovskaya
Saratov State University Saratov, Russia
The meningeal lymphatic vessels (MLVs) are an important part of the brain waste removal system (BWRS). A decrease in MLV function is associated with various brain diseases, including Alzheimer's and Parkinson's diseases, brain tumors and trauma. Augmentation of the BWRS might be an innovative and promising strategy for neurorehabilitation medicine. Here we discuss that photobiomodulation of the BWRS/MLVs during deep sleep is a breakthrough technology for the effective removal of metabolites and wastes from the brain in order to increase the neuroprotection of the brain as well as to prevent or delay neurodegenerative diseases.

ACPPOEM-0813-5
A Novel Fiber Optic Ring Cavity Oscillating DC Magnetic Field Sensing Technology Based on Phase Demodulation
Dongchao Liu
NR Electric Co., Ltd, China
This paper proposes a sensing technology based on fiber optic ring cavity oscillation structure for DC magnetic field detection requirements, which can be obtained by detecting the strength of the phase-locked output signal.
ACPPOEM-0813-9
Optical pulling of synthetic Janus particles mediated by photonic nanojet
Yuxuan Ren[1], Johannes Frueh[2], Sven Rutkowski[2], Cihang Kong[3], Bo Li[3], Kenneth Wong[4]
1.Fudan University, China; 2.National Research Tomsk Polytechnic University, Russia; 3.Fudan University, China; 4.Hong Kong University, Hong Kong, China
The Janus microparticle with an opaque metal layer on one side can be used to create a nanomotor. However, due to inhomogeneous coating, the Janus particle cannot concentrate light into a perfect nanojet. We report on the tunable asymmetric nanojet with a plasmonic Janus particle and anticipate that the asymmetric nanojet offers great possibilities to pull synthetic particles. Such scheme may be applied for parallel particle manipulation and classification.

ACPPOEM-0814-10
A deep learning-based model for human non-invasive vital sign signal monitoring with optical fiber sensor
Qichang Zhang, Qing Wang, Weimin Lyu, Changyuan Yu
The Hong Kong Polytechnic University, Hong Kong, China
This paper presents a non-contact monitoring system using micro-bend fiber sensors and deep learning. The system improves vital sign measurements, outperforming traditional methods, and holds the potential for medical diagnostics.

ACPPOEM-0814-14
Two-photon STED microscopy based on dual-Bessel beam
Renlong Zhang, Junle Qu
Campus of Physics and Optoelectronic Engineering, Shenzhen University, China
Stimulated emission depletion (STED) microscopy has gained widespread applications in cellular super-resolution imaging and lithography, owing to its remarkable ability to surpass the diffraction limit. However, the presence of sample-induced aberrations disrupts the stability of the donut-shaped depletion light field, significantly compromising the performance of STED. As a result, imaging thick tissue samples poses significant challenges for STED. In this study, we propose a novel approach for Two-photon excited STED microscopy (TP-STED) that leverages Bessel beams and 1040 nm fs pulse excited laser. Specifically, we employ first-order Bessel beams for the depletion light and zero-order Bessel beams for the excitation light. Exploiting the self-healing properties of Bessel beams, this technique not only enhances the imaging depth but also preserves the resolution performance of STED. Results demonstrate that the utilization of Bessel beams enables a fourfold increase in axial information acquisition compared to Gaussian beams, while maintaining resolution. Our proposed technique holds tremendous potential for imaging thick tissue samples and enabling fast super-resolution imaging.

ACPPOEM-0814-19
Privacy-encrypted Lensless Camera for Face Recognition
Zheng Huang[1,2], Wanxin Shi[1,2], Shukai Wu[1,2], Xin Liu[3], Chen Qian[3], Wentao Liu[3,4], Sigang Yang[1,2], Hongwei Chen[1,2]
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We propose a privacy-encrypted lensless camera. By an end-to-end joint optimization algorithm, we design an optical mask for multiple tasks within the face recognition process, achieving an impressive recognition result and a robust encryption effect.

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A Lensless Camera Simulator via Deep Learning
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We present a generative adversarial network that can simulate a lensless camera. This can efficiently generate datasets to fine-tune the electrical neural network against the gap between actual optical encoders and forward models in simulations.

ACPPOEM-0814-63
Diagnosis of dental caries in OCT images based on deep learning
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Optical Coherence Tomography (OCT), characterized by its non-invasive nature and high resolution, enables non-destructive, cross-sectional imaging of oral tissues.Deep learning (DL) has prominently contributed to dental medicine, specifically in tasks such as image recognition (IR), classification (CL), segmentation (SG), and quantification (QT), owing to its robust feature learning abilities and outstanding portability. Presently, prevalent clinical techniques employed in the identification of dental caries encompass visual examination and X-ray radiography. Nevertheless, these methodologies fall short in achieving precise identification of incipient enamel caries or visualization of minuscule structural alterations within dental structures. OCT has the capability to detect minute demineralized regions both on the surface and within the internal structure of teeth, thus overcoming the limitations associated with alternative optical detection methods.Initially, we employed a swept-source Optical Coherence Tomography (SS-OCT) system to conduct imaging and preliminary analysis on demineralized dental caries samples. Manual annotation of regions and relevant information associated with dental caries within OCT images to generate a United Statesble dataset.Subsequently, we trained and tested the dataset using three distinct object detection models: YOLOv5, Faster R-CNN, and RetinaNet. After training, the mean average precision achieved was 86%, 86%, and 75% respectively. The experimental results offer potential to expedite diagnosis time for clinicians, thereby serving as a foundation for supplementary diagnostic support by aiding medical professionals in making informed decisions.

ACPPOEM-0814-66
Machine learning-based fiber optic salinity sensor for temperature immunity
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In this work, a simple optical fiber sensor is designed and fabricated to accurately predict the seawater salinity by the machine learning method. The test set R^2 is higher than 0.99 even when instrument requirements are not stringent or temperature perturbations are present.

ACPPOEM-0815-6
Pd-WO_3 co-doped PVB film coated fiber grating for high-sensitive hydrogen sensing
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We propose and experimentally demonstrate a highly sensitive hydrogen (H_2) sensor by coating palladium (Pd)-tungsten trioxide (WO_3) co-doped polyvinyl butyral (PVB) nanofibers onto tilted fiber Bragg grating (TFBG). The tilted grating planes of the employed TFBG excite a set of cladding modes and strong evanescent field that can fully interact with the H_2-sensitive film. The Pd-WO_3 co-doped PVB nanofibers wrapped TFBG presents a sensitivity of 0.304 dB/% in the concentration range of 0%~1% by tracking the intensity of a specific cladding mode resonance. The high sensitivity, good repeatability, and reliability of the proposed H_2 sensor enable it to detect leak of low-concentration H_2.

ACPPOEM-0815-30
Smart Health Monitoring System Based on a Fiber Optic Sensor
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An optical fiber Mach-Zehnder interferometer (MZI) based smart health monitoring system using a vertical-cavity surface-emitting laser (VCSEL) is proposed. The feasibility of using FOS-based Ballistocardiography (BCG) to replace ECG in monitoring human signs is verified.

ACPPOEM-0815-34
SPR Refractive Index Sensor Based on Anti-resonant Fiber
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A refractive index (RI) sensor based on surface plasmon resonance (SPR) effect is proposed by using anti-resonant fiber structure. The sensor has an average sensitivity of 12,302 nm/RIU in the refractive index range of 1.26 to 1.41.

ACPPOEM-0815-79
Enhanced Velocity Measurement of Lidar by Optical Parametric Assisted Frequency Modulation
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A novel approach is proposed to enhance the velocity measurement range of frequency-modulated continuous-wave (FMCW) Lidar. By virtue of optical parametric assisted frequency modulation (OPAFM) method, the available range of velocity measurement can be double. In our experimental demonstration, the chirp rate of a frequency sweeping light is increased from 6.40 GHz/μs to 12.80 GHz/μs.Hence, the maximum measurable velocity for a target at 5.2 m can be improved from 2.13 m/s to 4.41 m/s.

ACPPOEM-0815-97
Delay-beat Differential Phase Demodulation for Laser Phase Noise Immunity in Phase-sensitive OTDR
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A phase demodulation method immune to laser phase noise based on time-delay beat-frequency coherent Φ-OTDR is proposed. In this method, the two Rayleigh backscattered light beams with time delay are beat with local light beams respectively, and the phase difference of the two beat signals is used instead of the traditional distance-difference phase to obtain the local disturbance information. In this way, the impact of laser phase noise introduce by the distance-difference phase is avoid, and the constraint of laser linewidth on phase demodulation performance is weakened. In the experiment, a demodulation accuracy of -63.5dB rad^2/Hz is achieved under the condition of a laser with a linewidth of 100kHz, which is improve by 11dB compared to traditional phase demodulation method.

ACPPOEM-0815-103
Ultrahigh resolution isotropic 3D nanoscopy by employing mirror-basedsingle-beaminterference
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A novel 3D isotropic super-resolution method based on single-beam interference is proposed. Combining with photon avalanching nanoparticles co-doped with Yb^{3+} / Pr^{3+}, isotropic imaging resolution below 70 nm (λ/12) was achieved under low-power, single-beam excitation.