

Optoelectronic Devices and Integration (OEDI)

Time: Monday-Tuesday, December 19-20, 2022

Online Conference Room: Zoom Code: 914 5144 1021 Password: 20221218

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City University of New York

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Daoxin DAI

Zhejiang University

Jian WANG

Huazhong University of Science and Technology

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Ke XU, Harbin Institute of Technology, Shenzhen

Liu LIU, Zhejiang University

Xinlun CAI, Sun Yat-sen University

13:30-15:10 December 19		
Hybrid Integration and Laser Applications I		
Presider: Yu ZHANG, Huazhong University of Science and Technology		
Time	Speaker	Talk Title
13:30-13:55	Xingjun WANG (Invited)	Microcomb-driven silicon photonic system
13:55-14:20	Yating WAN (Invited)	Integrated silicon photonics with on-chip lasers
14:20-14:45	Xiaojun XIE (Invited)	High-speed and high-power photodiodes for microwave photonics
14:45-15:10	Ruijun WANG (Invited)	Heterogeneously integrated photonic circuits for optical communication and sensing
15:25-17:15 December 19		
Hybrid Integration and Laser Applications II		
Presider: Yu ZHANG, Huazhong University of Science and Technology		
15:25-15:50	Xingchen JI (Invited)	Ultra low-loss silicon nitride photonic integrated circuits: fabrication and application
15:50-16:15	Pu LI (Invited)	Monolithically integrated chaotic semiconductor laser
Best Student Paper		
16:15-16:30	Limei XUE	Research on all-optical Comparator and Decoder based on SOA
16:30-16:45	Yihang DONG	On-chip Luneburg Lens for Ultra-Broadband and Ultra-Compact Silicon Waveguide Crossing
16:45-17:00	Shujun LIU	On-chip Digitally-tunable Dispersion Regulator
17:00-17:15	Hancheng LIU	Automatic calibration of a dilated-Benes 32 x 32 silicon optical switch

08:30-09:45 December 20**Emerging Applications in Integrated Photonics****President: Siqi YAN, Huazhong University of Science and Technology**

Time	Speaker	Talk Title
08:30-08:55	Yang YUE (Invited)	Integrated lidar using counter-propagating beams and WDM laser array
08:55-09:20	Heng ZHOU (Invited)	The generation and application of ultra-low noise Kerr soliton microcombs
09:20-09:45	Jingtao FAN (Invited)	TBD

10:00-11:40 December 20**Devices for High-Speed Communications****President: Yang YUE, Xi'an Jiaotong University**

Time	Speaker	Talk Title
10:00-10:25	Shuiying XIANG (Invited)	Photonic spiking neural networks: Chips and algorithms
10:25-10:50	Yonghui TIAN (Invited)	Integrated photonics devices based on silicon nitride and thin film lithium niobate hybrid platform
10:50-11:15	Zongyin YANG (Invited)	Miniaturization of optical spectrometers
11:15-11:40	Jing XU (Invited)	Parity-time symmetry based microcavity linewidth manipulation for linear and nonlinear integrated optics

13:30-15:15 December 20		
Optical and Photonic Systems		
Presider: Xiaojun XIE, Southwest Jiaotong University		
Time	Speaker	Talk Title
13:30-13:55	Quan PAN (Invited)	Low-power wireline/optical transceivers for emerging high-speed communications
13:55-14:20	Siqi YAN (Invited)	Graphene/silicon hybrid photodetector with enhanced responsivity and large bandwidth
14:20-14:45	Zhiteng LU (Invited)	Performance comparison of QAM and APSK-based bit- power-loading discrete multi-tone modulation in underwater visible light communication system
14:45-15:00	Nuo CHEN	Parity–time-symmetry enabled high-spectral-purity photon generation in multi-frequency channels
15:00-15:15	Ciyu GE	Efficient PbS quantum dot solar cells employing hydrogenated In ₂ O ₃ transparent electrode
15:30-16:30 December 20		
Optoelectronic Device Physics		
Presider: Jinwei ZENG, Huazhong University of Science and Technology		
Time	Speaker	Talk Title
15:30-15:45	Keqiang CHEN	Surface polarization of perovskite nanocrystals for excellent optical properties via green solvent engineering
15:45-16:00	Jianwei TANG	Photonic-circuited resonance fluorescence of single molecules with an ultrastable lifetime-limited transition
16:00-16:15	Yu CUI	Doping at counter electrode with limited depth – New findings on performance improvement in organic solar cells
16:15-16:30	Ji YANG	Ligand-engineered HgTe colloidal quantum dot solids for infrared photodetectors

Heterogeneous Integration and Laser Applications I

Monday, December 19, 2022 (13:30-15:10)

Presider: Yu ZHANG, Huazhong University of Science and Technology

13:30-13:55 (Invited)

Microcomb-driven silicon photonic system

Xingjun WANG

Peking University

Abstract: We present several important microcomb-based integrated silicon photonic chip-scale photonic systems for optical data transmission and microwave photonics, optical computing, respectively. Such synergy of a microcomb and SiPh integrated components is an essential step towards the next generation of fully integrated photonic systems.

13:55-14:20 (Invited)

Integrated silicon photonics with on-chip lasers

Yating WAN

King Abdullah University of Science & Technology

Abstract: As the most promising integration platform, Si photonics demands on-chip lasers. This talk sheds light on the current state of application-driven on-chip Si lasers and aims to inspire further development in incorporating PICs with on-chip lasers.

14:20-14:45 (Invited)

High-speed and high-power photodiodes for microwave photonics

Xiaojun XIE

Southwest Jiaotong University

Abstract: High-speed and high-power photodiodes are key components in microwave photonic applications including analog photonics link, microwave signal generation, and antenna remoting. Photonic integration technologies have enabled integrated microwave photonics. This talk reviews progress in discrete and integrated photodiodes for microwave photonics. Recent results from high-power photodiodes with 165 GHz bandwidth will be discussed.

14:45-15:10 (Invited)

Heterogeneously integrated photonic circuits for optical communication and sensing

Ruijun WANG

Sun Yat-sen University

Abstract: We present our recent work on the development of heterogeneously integrated III-V-on-silicon and III-V-on-lithium niobate photonic circuits. This integration approach enables large-volume, low-cost manufacturing of on-chip photonic systems for next-generation optical communication and sensing applications. It also provides a route to realize advanced semiconductor lasers.

Heterogeneous Integration and Laser Applications II**Monday, December 19, 2022 (15:25-17:15)****President: Yu ZHANG, Huazhong University of Science and Technology****15:25-15:50 (Invited)****Ultra low-loss silicon nitride photonic integrated circuits: fabrication and application**

Xingchen JI

Shanghai Jiao Tong University

Abstract: Silicon nitride has attracted extensive interest due to its ability to achieve ultra-low loss while maintaining small footprints. Si₃N₄ has been widely used in fields such as biophotonics, telecommunications, nonlinear optics, and sensing. Here, we will discuss the fabrication method and the application of ultra-low loss Si₃N₄ photonic integrated circuits.

15:50-16:15 (Invited)**Monolithically integrated chaotic semiconductor laser**

Pu LI

Guangdong University of Technology & Taiyuan University of Technology

Abstract: Optical chaos have great application in guarantee the information security. However, most of the chaotic light sources are constructed using various active and passive devices. This induces their large size and instability in practice. To this issue, we design and fabricate a photonic integrated chaotic semiconductor laser chip based on a mutual coupled structure. Moreover, we demonstrate this laser chip can successfully generate high-speed random numbers with a bit rate at the level of 100 Gb/s.

16:15-16:30 (Oral)**Research on all-optical Comparator and Decoder based on SOA**

Limei XUE

Taiyuan Normal University

Abstract: In order to realize all-optical high-speed communication network, it is necessary to adopt all-optical processing at the nodes of information transmission and information processing. The all-optical logic gate based on semiconductor optical amplifier (SOA) is a basic component. The logic relation of output $A\bar{B}$ is realized by using the cross-gain modulation effect of SOA, some combinatorial designs are made to realize the function of all-optical comparison and decoding. The theoretical analysis and experimental verification are carried out by using the numerical simulation method, and a bit comparator and a decoder under the all-optical logic combination are obtained. At the same time, the influence of the input parameters on the experimental results is analyzed and optimized.

16:30-16:45 (Oral)**On-chip Luneburg Lens for Ultra-Broadband and Ultra-Compact Silicon Waveguide Crossing**

Yihang DONG

Shanghai Jiao Tong University

Abstract: Here we propose and experimentally demonstrate an ultra-broadband and ultra-compact silicon waveguide crossing assisted by an on-chip metamaterial-based Luneburg lens. Furthermore, our scheme could also be expanded to design waveguide crossings that support high-order modes.

16:45-17:00 (Oral)

On-chip Digitally-tunable Dispersion Regulator

Shujun LIU

Zhejiang University

Abstract: A digitally-tunable dispersion regulator on silicon is proposed and demonstrated with 15 multimode Bragg gratings in cascade. The dispersion is tuned from 2.82 ps/nm to 42.8 ps/nm experimentally.

17:00-17:15 (Oral)

Automatic calibration of a dilated-Benes 32×32 silicon optical switch

Hancheng LIU

Shanghai Jiao Tong University

Abstract: We demonstrate the automatic calibration of a 32×32 optical switch consisting of 192 MZIs and 64 on-chip photodetectors. The calibration time is less than 17 minutes, which promotes the application of large-scale optical switches.

Emerging Applications in Integrated Photonics

Tuesday, December 20, 2022 (08:30-09:45)

President: Siqi YAN, Huazhong University of Science and Technology

08:30-08:55 (Invited)

Integrated lidar using counter-propagating beams and WDM laser array

Yang YUE

Xi'an Jiaotong University

Abstract: We design a solid-state Lidar using two trans-electrical polarized beams counter-propagating towards each other to effectively increase the steering angle. Furthermore, a low-priced Lidar is designed for trans-electrical polarized beams by using wavelength division multiplexed laser array to achieve a larger scale and a significant cost saving.

08:55-09:20 (Invited)

The generation and application of ultra-low noise Kerr soliton microcombs

Heng ZHOU

University of Electronic Science and Technology of China

Abstract: Recent advances in high finesse optical microresonators have provided a promising platform

for study of cavity nonlinear dynamics and offered a reliable route for building chip-scale ultrashort pulses and Kerr frequency combs. In this talk, I will present our recent results on: i). the generation of Kerr soliton microcombs with ultra-low time jitter, and ii). using ultra-low phase noise Kerr combs for coherent data communications.

09:20-09:45 (Invited)

TBD

Jingtao FAN

Tsinghua University

TBD

Devices for High-Speed Communications

Tuesday, December 20, 2022 (10:00-11:40)

President: Yang YUE, Xi'an Jiaotong University

10:00-10:25 (Invited)

Photonic spiking neural networks: Chips and algorithms

Shuiying XIANG

Xidian University

Abstract: We design and fabricate photonic spiking neurons based on semiconductor laser chips. Based on coherent/incoherent injection of two cases of semiconductor laser chips, we experimentally demonstrated neuron-like dynamics including temporal integration, spike threshold, and refractory period. Furthermore, we realized hardware-algorithm computing of photonic spiking neural network for pattern recognition tasks.

10:25-10:50 (Invited)

Integrated photonics devices based on silicon nitride and thin film lithium niobate hybrid platform

Yonghui TIAN

Lanzhou University

Abstract: We develop the silicon nitride and thin film lithium niobate (TFLN) hybrid platform for integrated TFLN photonics devices, in which not only the etching of lithium niobate can be avoided, but also we can take full of advantages of LN's excellent electro-optic effect to achieve high performance photonics devices.

10:50-11:15 (Invited)

Miniaturization of optical spectrometers

Zongyin YANG

Zhejiang University

Abstract: We summarize the technologies that have emerged toward miniaturizing of optical spectrometers—including miniaturized dispersive optics, narrowband filter systems, Fourier transform interferometers, and reconstructive microspectrometers. We will also present our studies in the microspectrometers and discuss the challenges associated with improving spectral resolution while device dimensions shrink ever further.

11:15-11:40 (Invited)

Parity-time symmetry based microcavity linewidth manipulation for linear and nonlinear integrated optics

Jing XU

Huazhong University of Science and Technology

Abstract: We explore the unique feature of parity-time symmetry to selectively manipulate the linewidths of microcavities at different resonant frequencies. We show the potential of linewidth manipulation for the applications of tunable optical filters as well as robust microcomb generations, as an example of linear and nonlinear integrated optics, respectively.

Optical and Photonic Systems

Tuesday, December 20, 2022 (13:30-15:15)

Presider: Xiaojun XIE, Southwest Jiaotong University

13:30-13:55 (Invited)

Low-power wireline/optical transceivers for emerging high-speed communications

Quan PAN

Southern University of Science and Technology

Abstract: Low-power wireline/optical integrated circuits have become extremely attractive since they are extensively adopted in high-speed communications, such as local area networks, board-to-board, and data center-to-data centers. Energy-efficient 10-224Gbps/lane links with sophisticated equalizations and modulations are studied, including transimpedance amplifiers, analog front-ends, high-speed drivers, clock data recovery circuits and PLLs.

13:55-14:20 (Invited)

Graphene/silicon hybrid photodetector with enhanced responsivity and large bandwidth

Siqi YAN

Huazhong University of Science and Technology

Abstract: We demonstrate a high-performance silicon/graphene photodetector employing novel double-slot structures. With the optimized structural parameters. Based on the double slot structure, the demonstrated photodetector holds a high responsivity of 603.92 mA/W and a large bandwidth of 78 GHz, providing a competitive solution for the silicon photodetector.

14:20-14:45 (Invited)

Performance comparison of QAM and APSK-based bit-power-loading discrete multi-tone modulation in underwater visible light communication system

Zhiteng LU

Fudan University

Abstract: We set up an UVLC system and achieve 3.18Gbps transmission rate with APSK modulation format below 3.8×10^{-3} BER threshold based on adaptive bit-power-loading algorithm, and experimental results indicate APSK has better performance in nonlinear operation range.

14:45-15:00 (Oral)

Parity-time-symmetry enabled high-spectral-purity photon generation in multi-frequency channels

Nuo CHEN

Huazhong University of Science and Technology

Abstract: An on-chip high-spectral-purity single photon generation method based on the parity-time-(PT-) symmetric coupled dual-ring resonators is proposed, enabling pure, single frequency-mode photons emission in multi-frequency channels, which is desired in quantum technologies.

15:00-15:15 (Oral)

Efficient PbS quantum dot solar cells employing hydrogenated In_2O_3 transparent electrode

Ciyu GE

Huazhong University of Science and Technology

Abstract: We develop a simple and low-cost method to fabricate high-mobility and high transmittance IHO film. We achieve a new record Si-filtered efficiency of 1.25% on the narrow-bandgap PbS QD solar cells by using the IHO film.

Optoelectronic Device Physics

Tuesday, December 20, 2022 (15:30-16:30)

Presider: Jinwei ZENG, Huazhong University of Science and Technology

15:30-15:45 (Oral)

Surface polarization of perovskite nanocrystals for excellent optical properties via green solvent engineering

Keqiang CHEN

China University of Geosciences

Abstract: A green solvent process, namely, co-solvent assisted reprecipitation (CSARP), is proposed to synthesize high quality MHP NCs under ambient conditions. Moreover, the as-received NCs exhibit near unit photoluminescence quantum yield (PLQY) and enhanced stability.

15:45-16:00 (Oral)

Photonic-circuited resonance fluorescence of single molecules with an ultrastable lifetime-limited transition

Jianwei TANG

Huazhong University of Science and Technology

Abstract: Resonance fluorescence of single molecules promises indistinguishable single photons for quantum technologies. In this talk we report on-chip generation, beam splitting and routing of background-free resonance-fluorescence single photons from single molecules with an ultra-stable lifetime-limited transition.

16:00-16:15 (Oral)

Doping at counter electrode with limited depth – New findings on performance improvement in organic solar cells

Yu CUI

Xi'an Jiaotong University

Abstract: Solution-based molecular doping is a key factor in unlocking the potential of organic electronic devices; however, controlling the diffusion of dopants and their stability in organic semiconductors has proven challenging. A doping method based on solution processing is proposed: asymmetric doping with limited depth on the cathode side of the active layer of OPV devices is achieved by sequentially spin-coating BCF solutions in acetonitrile. This cathode p-doping can alter the electric field distribution in the device and facilitate charge extraction and collection, and the doped photovoltaic device shows increased filling and efficiency. We demonstrate that this cathode p-doping strategy is ubiquitous in highly efficient polymer donor/non-fullerene small molecule acceptor systems, and future research will focus on extending this doping strategy to a wider range of OPV systems.

16:15-16:30 (Oral)

Ligand-engineered HgTe colloidal quantum dot solids for infrared photodetectors

Ji YANG

Huazhong University of Science and Technology

Abstract: HgTe colloidal quantum dots (CQDs) are promising absorber systems for infrared detection due to their widely-tunable photoresponse in all infrared regions. Up to now, the best-performing HgTe CQD photodetectors have relied on using aggregated CQDs, limiting device design, uniformity and performance. Herein, we report a ligand-engineered approach that produces well-separated HgTe CQDs. The present strategy first employs strong-binding alkyl thioalcohol ligands to enable the synthesis of well-dispersed HgTe cores, followed by a second growth process and a final post-ligand modification step enhancing their colloidal stability. We demonstrate highly monodisperse HgTe CQDs in a wide size range, from 4.2 to 15.0 nm with sharp excitonic absorption fully covering short- and mid-wave infrared regions, together with a record electron mobility up to $18.4 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$. Photodetectors with a $1.7 \mu\text{m}$ cutoff absorption edge show a room-temperature detectivity of 3.9×10^{11} Jones.