NJU NIP NOV 9-11, 2018 Nanjing, China

a nature conference on Nanophotonics and Integrated Photonics 2018

NIP 2018

自然学术会议 —— 纳米光子学和集成光子学

中国・南京

2018年11月9-11日

PROGRAM

南京大学 NANJING UNIVERSITY

nature electronics

nature materials

nature nanotechnology

nature photonics

nature research

NJU NIP NOV 9-11, 2018 Nanjing, China
a nature conference on Nanophotonics and Integrated Photonics 2018

NJU NIP
NOV 9-11, 2018
Nanjing, China

a nature conference on Nanophotonics and Integrated Photonics 2018

Important Contacts

Responsibility	Contact	Mobile	Email
Secretary Genaral	Fang Zhong	+86-151 5056 4094	zhongf@nju.edu.cn
Secretary Genaral	Nina Lu	+86-150 5058 5015	nlu@nju.edu.cn
Registration	Nina Lu	+86-150 5058 5015	nlu@nju.edu.cn
Invited Speakers	Fang Zhong	+86-151 5056 4094	zhongf@nju.edu.cn
Accomodation and Transportation	Nina Lu	+86-150 5058 5015	nlu@nju.edu.cn
	Zhixiang Li	+86-182 2248 4653	nature@nju.edu.cn
Sponsors	Xiaomei Ding	+86-136 7518 0629	215899840@qq.com
Program and Poster	Qi Zhu	+86-188 0518 5837	qizhu@nju.edu.cn
	Wei Chen	+86-136 8213 8100	wchen@nju.edu.cn

Should you have any questions
please feel free to contact us

NJU NIP NOV 9-11,2018 Nanjing,China

a nature conference on Nanophotonics and Integrated Photonics 2018

NIP 2018 PROGRAM

Table of Contents

01 INTRODUCTION

02 ORGANIZING COMMITTEE

03 SCOPE

04 CONFERENCE VENUE / HOTEL & LOGISTICS

06 PROGRAM & SPEAKERS

11 POSTER LIST

16 TRANSPORTATION GUIDANCE

20 ACCOMMODATION & SHUTTLE BUS SERVICE

22 THE FLOORPLAN OF XINDI HOTEL

23 REGISTRATION

24 CONTACT US

24 SPONSORED BY

25 ABSTRACTS & NOTES

For electronic program please scan the QR code

Introduction

The Nature Conference on Nanophotonics and Integrated Photonics 2018 is held by Nanjing University and *Nature Photonics, Nature Nanotechnology, Nature Materials, Nature Electronics*. This Nature Conference aims to provide a platform to the scientists from the fields of nanophotonics and integrated photonics for reporting new findings, exchanging new ideas, and inspiring new concepts and designs. The compact format of this conference will allow for ample discussions and networking.

Plenary Speakers

Nader Engheta *(University of Pennsylvania)*
Shanhui Fan *(Stanford University)*
Michal Lipson *(Columbia University)*
Hong Tang *(Yale University)*
Xiang Zhang *(University of California, Berkeley)*

Invited Speakers

Aiqun Liu *(Nanyang Technological University)*
Amr Helmy *(University of Toronto)*
Anatoly Zayats *(King's College London)*
Chengwei Qiu *(National University of Singapore)*
Christine Silberhorn *(Paderborn University)*
Connie Chang-Hasnain *(UC Berkeley & Tsinghua-Berkeley Shenzhen Institute)*
David Moss *(Swinburne Australia)*
Din Ping Tsai *(Academia Sinica)*
Dirk Englund *(MIT)*
Hatice Altug *(Ecole Polytechnique Federale de Lausanne, Institute of Bioengineering)*
Jacob Khurgin *(Johns Hopkins University)*
Jason Valentine *(Vanderbilt University)*
Jennifer Dionne *(Stanford University)*
Jianbin Xu *(The Chinese University of Hong Kong)*
Joyce Poon *(University of Toronto)*
Laura Liu *(University of Heidelberg)*
Marko Loncar *(Harvard University)*
Moti Segev *(Technion Israel)*
Nikolay Zheludev *(University of Southampton & Nanyang) Technological University)*
Philip Walther *(University of Vienna)*
Romain Fleury *(EPFL)*
Romain Quidant *(ICFO Spain)*
Tobias Kippenberg *(EPFL)*
Val Zwiller *(TU Delft & KTH)*
Vladimir Shalaev *(Purdue University)*
Yuri Kivshar *(Australian National University)*
Zubin Jacob *(Purdue University)*
Cun-Zheng Ning *(Arizona State University; Tsinghua University)*
Chaoyang Lu *(University of Science and Technology of China)*
Jun He *(National Center for Nanoscience and Technology)*
Lei Zhou *(Fudan University)*
Ling Lu *(Institute of Physics, Chinese Academy of Sciences)*
Ping Xu *(Nanjing University)*
Renmin Ma *(Peking University)*
Yun-Jiang Rao *(University of Electronic Science and Technology of China)*

Organizing Committee

Chairs

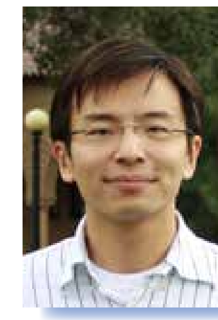
Honorary Chair
Shining Zhu
Nanjing University

Chair
Yan-Qing Lu
Nanjing University

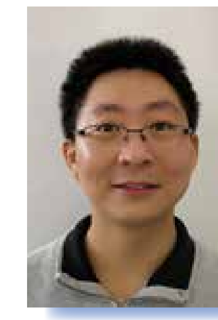
Co-Chair
Xiaosong Ma
Nanjing University

Members

Tao Li
Nanjing University



Jia Zhu
Nanjing University



Zhenda Xie
Nanjing University

Minghui Lu
Nanjing University

Maria Maragkou
Nature Materials

Alberto Moscatelli
Nature Nanotechnology

Christiana Varnava
Nature Electronics

Rachel Won
Nature Photonics

Scope

- *Quantum photonics*
- *Metamaterials*
- *Integrated photonics*
- *Plasmonics*
- *Energy photonics*
- *Topological photonics*

Conference Venue Hotel & Logistics

Introduction to Xindi Hotel

Address: 6 Xuedian Road, Qixia District, Nanjing, PRC Tel: 025-5263 8888 Post Code: 210046

Xindi Hotel, located in Xianlin University Town, is the only large-sized business hotel constructed under five-star standard in Qixia District, Nanjing City by now, with convenient communication, beautiful environment and charming landscape.

Located in Xianlin University Town, the hotel sees Golden Eagle Outlets beyond a lake, and is quite close to the Xianlin Zhongxin Station on Nanjing Metro Line 2. It takes about 30 minutes by vehicle from the hotel to Nanjing Railway Station through Xuanwu Avenue, and about 50 minutes to Nanjing Lukou International Airport. Its ideal location makes the hotel not only an excellent place for business affairs and scientific conferences, but also a convenient place to many scenic spots and historic sites.

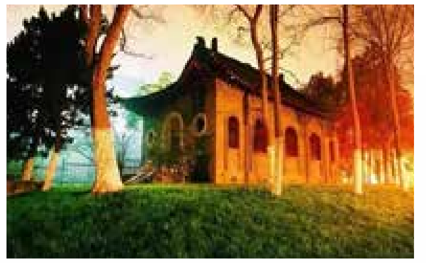



Xindi Hotel now contains 110 comfortable and luxurious guest rooms (suites), including superior rooms, deluxe rooms, lake view rooms and various suites, all with novel design and exquisite facilities, and are spacious and comfortable. Every room is equipped with FPTV, cozy worktable and high-speed internet access. We hope you have a pleasant stay here.

Introduction to Nanjing

Nanjing, an ancient capital of China, located in the downstream Yangtze River drainage basin and Yangtze River Delta economic zone, enjoys a worldwide reputation for its history and culture. It has achieved its fame as "an ancient capital of ten dynasties" in the past years. Nanjing has also served as a national hub of education, research, transportation and tourism throughout history, as well as an important commercial center in the East China region.





Nanjing is decorated by the majestic scenery intertwined with many cultural antiquities. To the east is Mt. Zhongshan, also called Zijin (Purple Golden) Shan Scenic Area. To the west of the mountain is the enthralling Mt. Qixia. The great Yangtze River traverses the northern part of the city and the spectacular scenery is best viewed from the railway & highway Bridge. Nanjing is also appealing for the blend of modern and classical offerings. One unique bustling area in Nanjing is Qin Huai River, cultivated some well-known talented and patriotic heroines at the turning point of the former dynasties. The well-trodden Confucius Temple is located beside the river. The most famous handicrafts in Nanjing are Yunjin Brocade and Yuhua Stone.

Program & Speakers

Friday, 9 Nov 2018

Time	(1st Floor – DIAMOND HALL)	
14:00-14:15	Opening Remarks	
14:15-15:15	Plenary Talk 1 – *Next generation photonics based on 2D materials* – Michal Lipson (Columbia University) *Chair: Min Xiao*	
15:15-15:25	Group Photo	
15:25-15:45	Coffee Break	
Time	A – Topological Photonics *Chair: Minghui Lu* (1st Floor – DIAMOND HALL)	B – Plasmonics I *Chair: Jia Zhu* (2nd Floor – PURPLE CRYSTAL)
15:45-16:15	Invited Talk A1 – *Photon spin-1 quantization in non-local phases of matter* – Zubin Jacob (Purdue University)	Invited Talk B1 – *New materials and applications for metasurfaces & 4D photonics* – Vladimir Shalaev (Purdue University)
16:15-16:45	Invited Talk A2 – *Topological one-way fibers* – Ling Lu (Institute of Physics, Chinese Academy of Sciences)	Invited Talk B2 – *Nonreciprocal nanophotonics with dielectric and plasmonic metasurfaces* – Jennifer Dionne (Stanford University)
16:45-17:15	Invited Talk A3 – *Topological spoof-plasmon polaritons for robust waveguiding at the subwavelength scale* – Romain Fleury (EPFL)	Invited Talk B3 – *Plasmonics: friend or foe for laser miniaturization?* – Renmin Ma (Peking University)

Time	A – Topological Photonics *Chair: Minghui Lu* (1st Floor – DIAMOND HALL)	B – Plasmonics I *Chair: Jia Zhu* (2nd Floor – PURPLE CRYSTAL)
17:15-17:45	Invited Talk A4 – *Topological photonics, topological insulator lasers, etc* – Moti Segev (Israel Institute of Technolgoy)	Invited Talk B4 – *Semiconductor nanolasers: from plasmonic confinement to 2D monolayer gain media* – Cun-Zheng Ning (Arizona State University & Tsinghua University)
17:45-18:00	Short Break	
18:00-19:00	Poster Session I	*Poster Zone (Outside Diamond Hall)*
19:00-20:30	Reception	*1st Floor Hupan Buffet Restaurant*
20:30-22:00	Poster Session I	*Poster Zone (Outside Diamond Hall)*

Saturday, 10 Nov 2018

Time	(1st Floor – DIAMOND HALL)	
9:00-10:00	Plenary Talk 2 – *Soft meta-materials: self-gauged assembly, non-equilibrium matters, and 3D super-resolution imaging* – Xiang Zhang (University of Hong Kong) *Chair: Yan-Qing Lu*	
10:00-10:30	Coffee Break	
Time	C – Metamaterials I *Chair: Tao Li* (2nd Floor – PURPLE CRYSTAL)	D – Quantum Integrated Photonics I *Chair: Ping Xu* (1st Floor – DIAMOND HALL)
10:30-11:00	Invited Talk C1 – *Mie-resonant all-dielectric nanophotonics and meta-optics* – Yuri Kivshar (Australian National University)	Invited Talk D1 – *New Opportunities with an Old Material* – Marko Loncar (Harvard University)
11:00-11:30	Invited Talk C2 – *Metalens for imaging and sensing* – Din Ping Tsai (Academia Sinica)	Invited Talk D2 – *Integrated quantum photonics: quantum emitters, detectors and circuits* – Val Zwiller (TU Delft & KTH)
11:30-12:00	Invited Talk C3 – *Nanophotonics of superoscillations : imaging and metrology applications* – Nikolay Zheludev (University of Southampton & Nanyang Technological University)	Invited Talk D3 – *Quantum optics and information science in multi-dimensional photonics networks* – Christine Silberhorn (Paderborn University)

12:00-13:30	Lunch *1st Floor Hupan Buffet Restaurant*	
Time	(1st Floor – DIAMOND HALL)	
13:30-14:30	Plenary Talk 3 – *Integrated $\chi^{(2)}$ photonics* – Hong Tang (Yale University) *Chair: Xiaosong Ma*	
14:30-15:00	*Coffee Break*	
Time	E – Metamaterials II *Chair: Ting Xu* (2nd Floor – PURPLE CRYSTAL)	F – Quantum Integrated Photonics II *Chair: Yong Zhang* (1st Floor – DIAMOND HALL)
15:00-15:30	Invited Talk E1 – *Dynamic optical metasurfaces* – Jason Valentine (Vanderbilt Universit)	Invited Talk F1 – *Lithium Niobate based quantum photonic chips* – Ping Xu (National University of Defense Technology & Nanjing University)
15:30-16:00	Invited Talk E2 – *Synthetic Interface Optics: Two two-dimensional surfaces better than one* – Chengwei Qiu (National University of Singapore)	Invited Talk F2 – *Toward quantum supremacy using solid-state single photons* – Chaoyang Lu (University of Science and Technology of China)
16:00-16:30	Invited Talk E3 – *Microresonator soliton frequency combs* – Tobias Kippenberg (EPFL)	Invited Talk F3 – *Advances in monolithic quantum photonics for sensing* – Amr Helmy (University of Toronto)
16:30-16:45	Short Break	
16:45-18:00	Poster Session II *Poster Zone (Outside Diamond Hall)*	
18:00-20:00	Conference Banquet and Awards Ceremony *1st Floor DIAMOND HALL*	
20:00-22:00	Poster Session II *Poster Zone (Outside Diamond Hall)*	

Sunday, 11 Nov 2018

Time	(1st Floor – DIAMOND HALL)
9:00-10:00	Plenary Talk 4 – *Functional waves* – Nader Engheta (University of Pennsylvania) *Chair: Ruwen Peng*
10:00-10:30	Coffee Break

Time	G – Plasmonics II *Chair: Peng Zhan* (2nd Floor – PURPLE CRYSTAL)	H – Quantum Integrated Photonics III *Chair: Lijian Zhang* (1st Floor – DIAMOND HALL)
10:30-11:00	Invited Talk G1 – *Hot electrons in electrically-driven plasmonic nanostructures* – Anatoly Zayats (King's College London)	Invited Talk H1 – *Photonic integrated circuits for scalable quantum networks* – Dirk Englund (MIT)
11:00-11:30	Invited Talk G2 – *Exploration of light detection and modulation with graphene-like layered materials* – Jianbin Xu (The Chinese University of Hong Kong)	Invited Talk H2 – *Integrated photonics for secure quantum computing and novel quantum communication tasks* – Philip Walther (University of Vienna)
11:30-12:00	Invited Talk G3 – *Excited carriers in metals: from icy cold to comfortably warm to scalding hot* – Jacob Khurgin (Johns Hopkins University)	Invited Talk H3 – *A single chip solution for continuous-variable quantum key distribution (CV QKD)* – Aiqun Liu (Nanyang Technological University)
12:00-13:30	Lunch *1st Floor Hupan Buffet Restaurant*	
Time	K – Plasmonics III *Chair: Zhenda Xie* (2nd Floor – PURPLE CRYSTAL)	L – Integrated Photonics *Chair: Weihua Zhang* (1st Floor – DIAMOND HALL)
13:30-14:00	Invited Talk K1 – *Putting nanoplasmonics to work!* – Romain Quidant (ICFO)	Invited Talk L1 – *High contrast metastructures for flat photonics applications* – Connie Chang-Hasnain (UC Berkeley & Tsinghua-Berkeley Shenzhen Institute)
14:00-14:30	Invited Talk K2 – *Two dimensional metal chalcogenides and the device application* – Jun He (National Center for Nanoscience and Technology)	Invited Talk L2 – *Metasurfaces: efficiency, couplings, and angular dispersions* – Lei Zhou (Fudan University)
14:30-15:00	Invited Talk K3 – *Dynamic plasmonics* – Laura Liu (University Heidelberg)	Invited Talk L3 – *From fiber optic networks to neuron networks: foundry integrated 3D silicon photonics* – Joyce Poon (University of Toronto)

Time	K – Plasmonics III *Chair: Zhenda Xie* (2nd Floor – PURPLE CRYSTAL)	L – Integrated Photonics *Chair: Weihua Zhang* (1st Floor – DIAMOND HALL)
15:00-15:30	Coffee Break	
15:30-16:00	Invited Talk K4 – *Mid-IR metasurfaces for molecular specific biosensors* – Hatice Altug (EPFL)	Invited Talk L4 – *Integrated optical fiber sensors* – Yunjiang Rao (University of Electronic Science and Technology of China)
16:00-16:30	Poster Talks	Invited Talk L5 – *Microwave and RF applications of Kerr micro-combs* – David Moss (Swinburne University of Technology)
16:30-16:45	Short Break	
16:45-17:45	Plenary Talk 5 – *Nanophotonic concepts for thermal and energy applications* – Shanhui Fan (Stanford University) *Chair: Lei Zhou*	
17:45-18:00	Closing Remarks	

Poster List

For downloading poster abstracts please scan the QR code.
http://light.nju.edu.cn/nip2018/Poster_Abstract.pdf

No.	Author	Title	Poster Session
1	Hansen Zhong	12-photon entanglement and scalable scattershot boson sampling with optimal entangled photon pairs from parametric down-conversion	I
2	Huazhou Chen	Imaging the dark emission of spasers	I
3	Xiaoxiao Wu	Direct observation of valley-locked topological edge states in designer surface plasmon crystals	I
4	Zhen Shen	Non-reciprocal photonic devices based on optomechanical microresonator	I
5	Yingying Zhu	Strong localization of surface plasmon polaritons with engineered disorder	I
6	Qi Guo	Photo-patterning of chiral smectic-C liquid crystal for electrically-addressed diffractive optical elements	I
7	Kai Wang	A non-local quantum delayed-choice experiment	I
8	Jing Zhou	Visualizing Mie resonances in low-index dielectric nanoparticles	I
9	Chen Chen	Tomographic microscopy by chromatic metalens	I
10	Jiafang Li	Nano-kirigami enabled 2D-to-3D transformations of photonic functional metastructures	I
11	Tong Wu	Experimental multi-photon quantum walk on a directed graph	I
12	Kunpeng Jia	Mid-infrared $\chi^{(2)}$ frequency comb generation from a dielectric superlattice box resonator	I
13	Wenchan Dong	An integrated all-optical programmable logic array using cross gain modulation based on semiconductor optical amplifiers	I
14	Xiaohu Wu	Strong chiral response in the whole visible band	I
15	Suo Wang	Unusual scaling laws for plasmonic nanolasers beyond the diffraction limit	I
16	Wang Zhang	Evolution of orbital angular momentum in a soft quasi-periodic structure with topological defects	I
17	Chi Li	High nonlinear light-field-driven photoemission from carbon nanotubes	I
18	Huizeng Li	Au-areoles arrayed microchip for multiple trace SERS detection	I
19	Tiancheng Han	Full-parameter omnidirectional thermal meta-devices of anisotropic geometry	I
20	Mingbo He	Hybrid silicon and lithium niobate Mach–Zehnder modulators for 100 Gbits and beyond	I
21	Lemeng Leng	High-density waveguide integration and optical phased arrays	I
22	Lan Wang	THz enhanced EIT resonance based on the coupled electrical dropping effect with undulating meta-surface	I
23	Yanqing Hu	Hard evidence revealing the cause of thermally-induced luminescence enhancement in upconversion nanocrystals	I

No.	Author	Title	Poster Session
24	Xinyu Liao	Octave spanning supercontinuum generation in air cladding tantalum pentoxide based optical waveguide	I
25	Yinzhu Jiang	Rabi splitting in photoluminescence of gold nanorod–WS_2 heterostructure	I
26	Zhixia Xu	Induce surface plasmon on thin gold films using dimer-structure plasmonic metadevices	I
27	Qiuyang Jiang	High extinction ratio 2×2 thermo-optic switch in silicon	I
28	Ruxue Wang	Exciting and shaping the Bloch surface wave	I
29	Yang Li	Gradient index metamaterials for enhancing local field	I
30	Chang Li	Janus structural color from a 2D photonic crystal hybrid with a Fabry–Perot cavity	I
31	Qi Chen	Demonstration of a next generation of satellite laser ranging with superconductor single photon detector array	I
32	Hongliang Hao	Strong damping of the localized surface plasmon resonance of metal nanoparticles and its applications	I
33	Lei Tang	A near-perfect chiral single-photon interface:isolation and unidirectional emission	I
34	Xuexian Chen	Strong plasmon–exciton coupling in single Au nanohole–monolayer WS_2 hybrid nanostructures	I
35	Yineng Liu	Metasurface realization for complementary medium-type optical illusion	I
36	Pengfei Qin	Toroidal Response Based on Localized Spoof Plasmons	I
37	Hao Jing	Broadband integrated polarization rotator using three-layer metallic grating structures	I
38	Yongchao Li	Optically controllable superconducting electromechanical oscillator	I
39	Xueqiong Su	Investigation of thermal evolution in $Ge_xAs_ySe_{1-x-y}$ thin films by in-situ measurements	I
40	Yifan Xu	Plasmon enhanced optical coherence tomography imaging using nanorods of large aspect ratios	I
41	Pu Zhang	Rigorous analysis and engineering of radiation pattern of single emitters in anisotropic planar structure via coupling to nanoantenna	I
42	Jing Zhou	Suppressing ohmic loss and enhancing active material absorption in a plasmonic cavity	I
43	Yunfei Zou	Strong coupling between a quasi-single molecule and a plasmonic cavity based on molecules trapping in the blue-detuned trapping system	I
44	Bamadev Das	Strain induced Terahertz modulation in nanogap	I
45	Fangzhou Shu	Dynamic plasmonic color generation based on phase transition of vanadium dioxide	I
46	Mingzhu Li	High efficient perovskite photovoltaic devices through nanophotonic light trapping	I
47	Wei Kou	Independent linear dual-polarization Terahertz focusing at a composite multifunctional metasurface	I
48	Xinyu Chai	Green synthesis and characterization of graphene quantum dots prepared from D-xylose	I
49	Zeying Zhang	Precisely control of nanoparticles assembly and patterning for three-primary-color micro-light-emitting arrays	I

No.	Author	Title	Poster Session
50	Jun Xing	Dramatically enhanced photoluminescence from femtosecond laser induced micro/nano-structures on $MAPbBr_3$ single crystal surface	I
51	Wei Liu	CO_2-assisted fabrication of amorphous molybdenum oxide for enhanced plasmon resonances	I
52	Tianchi Zhou	THz ultra-high Q meta-surface based on the tip coupling enhanced FANO resonance	I
53	Xinhe Jiang	Quantum teleportation of surface plasmon polariton	II
54	Baicheng Yao	Gate-tunable Kerr combs in graphene-nitride microresonators	II
55	Xintao He	A silicon-on-insulator slab for topological valley transport	II
56	Chengzhi Qin	Frequency diffraction management through photonic gauge potentials and effective electric-field forces	II
57	Yi Xu	Six dimensional light-matter interactions	II
58	Haowen Liang	High numerical aperture crystalline silicon metalenses and applications at visible wavelengths	II
59	Zhizhou Lu	Dissipative Kerr solitons generation and switching in a thermally controlled micro-ring resonator	II
60	Yubo Xie	Integrated quantum memory based on rare-earth ion nanowire	II
61	Lantian Feng	On-chip photonic quantum sources based on silicon waveguides	II
62	Wange Song	Topologically protected edge states for robust integrated photonic devices	II
63	Xu Wang	Engineered graphene GaAs van der Waals heterostructures and InAs quantum dots for mode-locked laser	II
64	Liangliang Lu	Entangled qutrits on a silicon chip	II
65	Biye Xie	Second-order photonic topological insulator with corner states	II
66	Meng Su	Self-assembling of nanomaterials via droplet manipulation for multifunctional optoelectronics devices	II
67	Yuansong Zeng	Efficient conversion between plasmonic waves and spin optical waves enabled by nanopatch antenna array	II
68	Xinchao Lu	The study on plasmonics imaging to single nanoparticle	II
69	Jiawei Lv	Bio-inspired chiral photonic crystals	II
70	Thomas Lettner	Bright and tunable single-photon sources for quantum optics	II
71	Xueke Duan	Length-relaxed nanocavity for large spontaneous emission enabled by epsilon-near-zero substrate	II
72	Zebo Zheng	Mid-infrared biaxial hyperbolic phonon polaritons in a van der Waals crystal	II
73	Zhubing He	Hexagonal packed tungsten nanocylinder array as efficient selective solar absorber for concentrating solar thermoelectrical generator	II
74	Liang Xu	Weak-measurement-enhanced metrology in the presence of CCD noise and saturation	II
75	Shumin Xiao	Dynamic color displays using all-dielectric metasurfaces	II
76	Yuanmu Yang	High-harmonic generation in an epsilon-near-zero material	II
77	Jing Zhou	Enhancing graphene photoresponse by an optical patch antenna	II

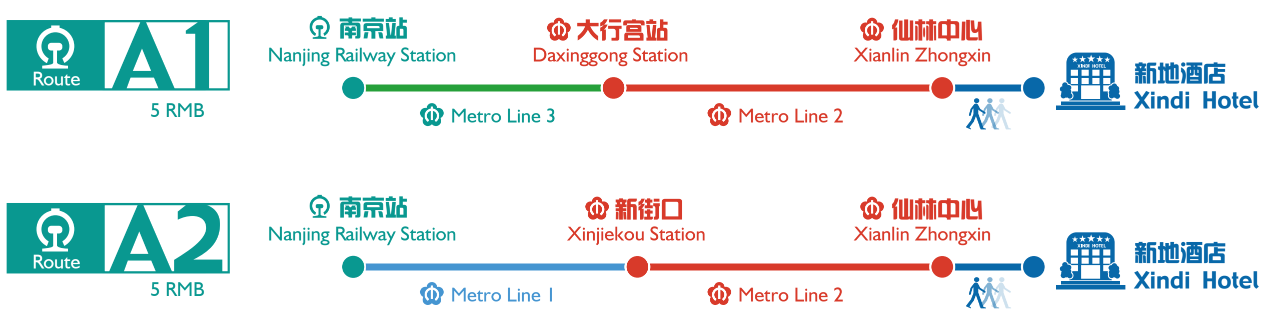
No.	Author	Title	Poster Session
78	Kaixuan Li	Tunable whispering gallery mode lasing from the printed high-Q microdisk	II
79	Yanlin Song	Green printing technology for colloidal photonic crystals	II
80	Weiwei Zhu	Topological properties of comb-like waveguide systems	II
81	Qiang Li	On-demand generation and depth control of shallow silicon vacancy in silicon carbide	II
82	Kaimin Zheng	Deterministic phase estimation in standard quantum limit with real-time feedback control	II
83	Rui Niu	Repetition rate tuning of soliton in microrod resonators	II
84	Yanjing Zhao	Optical frequency comb generation based on high order mode in a thin micro-ring resonator	II
85	Peiyan Zhao	High speed silicon Mach-Zehnder modulator via a pilot run	II
86	Gaoneng Dong	High-contrast and low-power all-optical switch using fano resonance based on a silicon nanobeam cavity	II
87	Chao Zhuang	Plasmonic photothermoelectric generator	II
88	Aonan Zhang	Device-independent characterization of quantum measurements	II
89	Sajid Ur Rehman	Novel Cubic Tin Sulfide (π-SnS) chalcogenide as a potential candidate for optoelectronic and energy storage devices	II
90	Jianbin Liu	Scattering-immune surface-wave open resonator for arbitrary disorders	II
91	Woongkyu Park	Terahertz-induced resist polymerization in nanoantennas	II
92	Ximiao Wang	Mid-infrared edge plasmon modes of chemically-doped graphene	II
93	Junfeng Lu	Piezoelectric effect tuning on ZnO microwire WGM lasing	II
94	Xinjie Lv	Generation of optical frequency comb in a $\chi^{(2)}$ sheet micro optical parametric oscillator via cavity phase matching	II
95	Weiyang Cai	Optical focusing based on the planar metasurface reflector with application to trapping cold molecules	II
96	Fengsheng Sun	Hybridized plasmon–phonon modes supported in graphene/MoO_3 stacked hybrid structures	II
97	Shunyu Yao	Generation of visible Kerr comb and platicon via Raman assisted four wave mixing in microresonator	II
98	Stephan Steinhauer	Excitonic quantum states in Cu_2O microcrystals grown on silicon substrates	II
99	Xi Yang	Turbidimetric inhibition immunoassay revisited to enhance its sensitivity by optofluidic laser	II
100	Zhenqian Yang	High performance single crystalline perovskite thin film photodetector	II
101	Tanchao Pu	Ultra-high reflectivity all-dielectric metasurface at ultra-violet wavelength	II
102	Guangchao Zheng	A large-scale synthetic methods for tuning the morphology and chiroptical properties of discrete chiral gold nanorods	II
103	Xueqing Liu	High precision fabrication of sapphire micro-optical elements by femtosecond laser and dry etching	II

No.	Author	Title	Poster Session
104	John Ho	Radio surface plasmons on metamaterial textiles for efficient and secure body networks	II
105	Yang Sun	Electromagnetic engineered mechanical trapping potential and the conversion in optomechanical system	II
106	Suo Wang	High performance plasmonic nanolasers with external quantum efficiency exceed 10%	II
107	Ran Hao	Wideband slowlight in grating waveguide	II
108	Ziwei Liu	Low refractive index coating induced resonant Kerker effect	I
109	Siyi Min	Refractometric sensing using gradient plasmonic nanostructures: mapping spectral information to spatial patterns	I

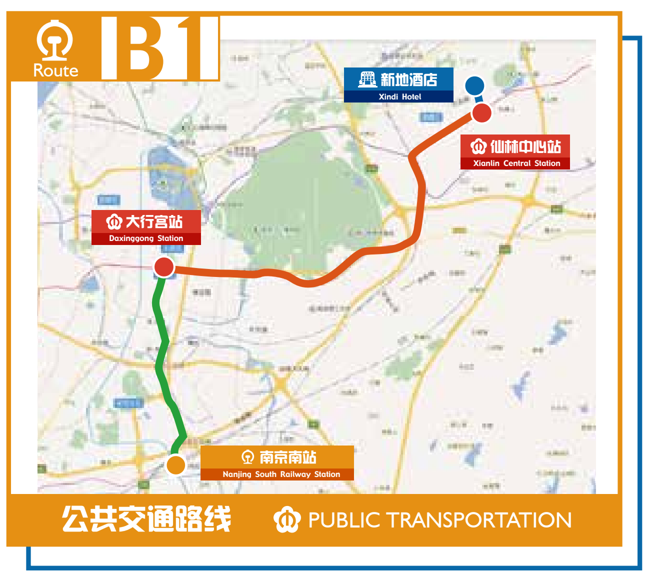
Transportation Guidance

Taxi Route

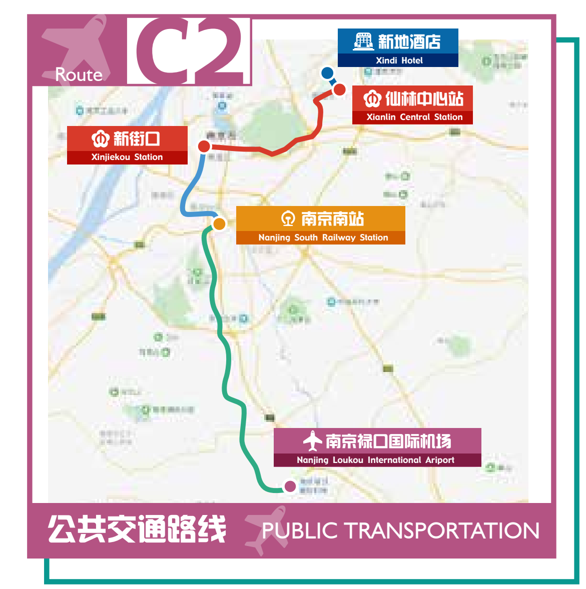
Public Transportation



Public Transportation



Public Transportation

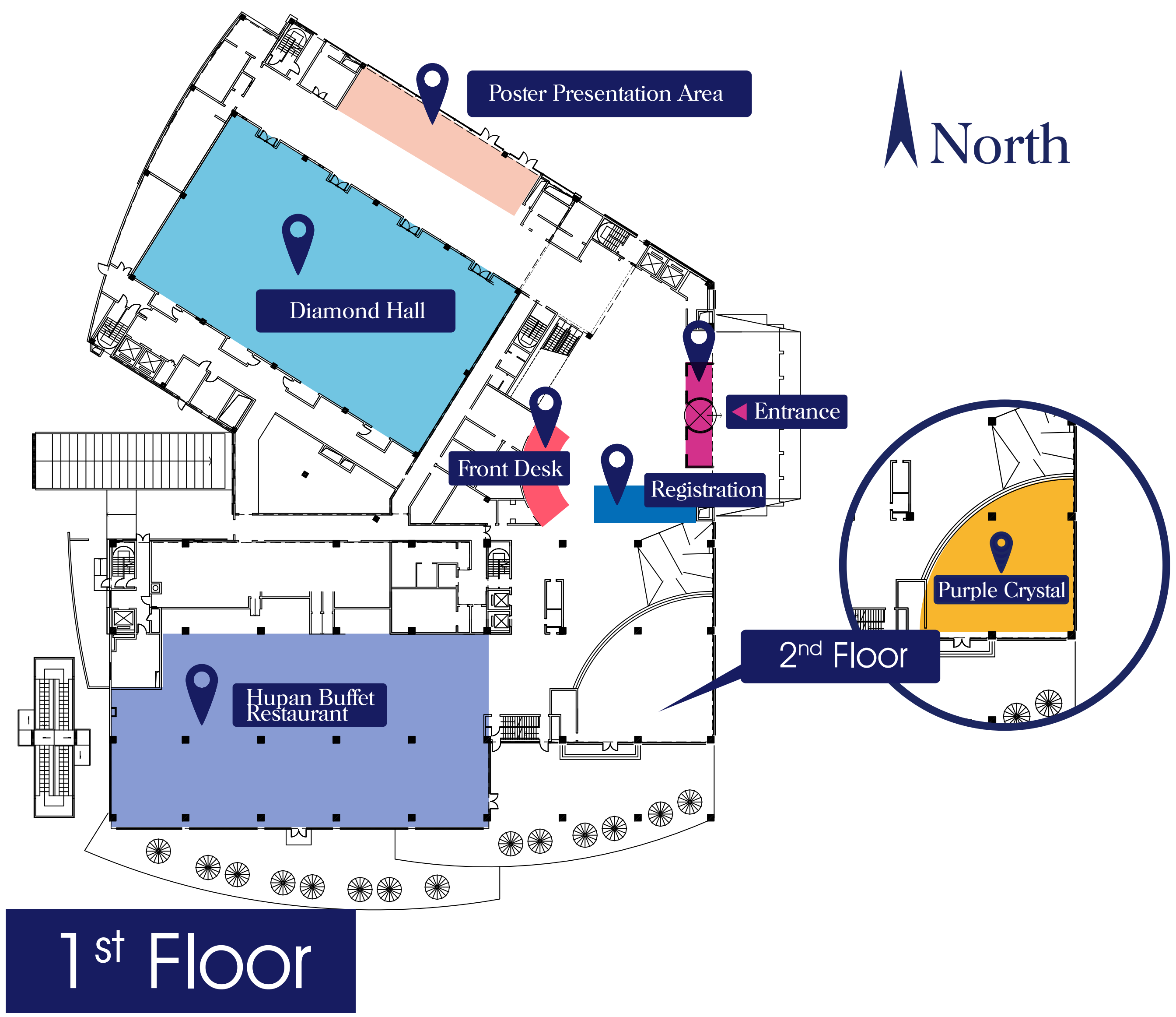


Accommodation & Shuttle Bus Service

Shuttle Bus Service

Date	Time		
2018-11-9	13:15	南京中公汇悦大酒店 OFFCN HY HOTEL	新地酒店 XINDI HOTEL
	20:00、20:30	新地酒店 XINDI HOTEL	南京中公汇悦大酒店 OFFCN HY HOTEL
2018-11-10	08:10、08:30	南京中公汇悦大酒店 OFFCN HY HOTEL	新地酒店 XINDI HOTEL
	20:00、20:30	新地酒店 XINDI HOTEL	南京中公汇悦大酒店 OFFCN HY HOTEL
2018-11-11	08:10、08:30	南京中公汇悦大酒店 OFFCN HY HOTEL	新地酒店 XINDI HOTEL
	20:00	新地酒店 XINDI HOTEL	南京中公汇悦大酒店 OFFCN HY HOTEL
Date	**Time**		
2018-11-9	13:00	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center	新地酒店 XINDI HOTEL
	20:00	新地酒店 XINDI HOTEL	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center
2018-11-10	08:10	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center	新地酒店 XINDI HOTEL
	20:00	新地酒店 XINDI HOTEL	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center
2018-11-11	08:10	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center	新地酒店 XINDI HOTEL
	20:00	新地酒店 XINDI HOTEL	南京紫东生态会议中心 Nanjing Purple East ecological Conference Center

The Floorplan of Xindi Hotel



Registration

Registration Fees

	Early Registration by Sep. 10, 2018	Regular Booking by Nov. 9, 2018
Student	RMB1500/USD200	RMB1800/USD250
Academic	RMB2500/USD350	RMB3000/USD400
Industry	RMB5000/USD730	RMB5000/USD730

Registration Fee Includes

- Admission to All scientific sessions
- Admission to Poster sessions
- Meals as indicated in the conference program
- Program book

Registration fees do not include accommodation.

Contact US

If you have any questions, please feel free to contact us.

General Enquiries: nature@nju.edu.cn
(website: https://www.nature.com/natureconferences/NIP18/index.html
http://light.nju.edu.cn/nip2018/index.aspx)
Registration: nature@nju.edu.cn (http://light.nju.edu.cn/NIP2018/login.aspx)

Prof. Xiaosong Ma	Ms. Fang Zhong
Co-Chair *Tel: +86-25-83592270* *Email: xiaosong.ma@nju.edu.cn*	Secretary *Tel: +86-151 5056 4094* *Email: zhongf@nju.edu.cn*
Ms. Nina Lu	**Ms. Xiaomei Ding**
Secretary *Tel: +86-150 5058 5015* *Email: nlu@nju.edu.cn*	Secretary *Tel: +86-136 7518 0629* *Email: 215899840@qq.com*

Sponsored by

Abstracts & Notes

Abstracts & Notes

Plenary Talk 1

Next Generation Photonics Based on 2d Materials

Michal Lipson

Columbia University, 530 West 120th Street, NY, NY 10027, USA
Email: ml3745@columbia.edu / Phone: 212-854-0604

Abstract: Two dimensional materials such as monolayer transition metal dichalcogenides (TMD) are expected to have large changes in their optical sheet conductivity by controlling their carrier densities. We demonstrate a platform for waveguide-integrated phase modulators in the near-infrared regime based on Tungsten disulphide (WS_2) gating.

Notes

A1

Photon Spin-1 Quantization in Non-Local Phases of Matter

Zubin Jacob

Purdue University

Abstract: We exploit the the symmetry in the continuum field theories of fermions and bosons to propose new topological phases of matter. This theory, the Dirac-Maxwell correspondence, necessarily requires non-local response and is valid for matter at the atomic scale. The hallmark of such new phases are three fundamental attributes (1) photon spin-1 quantization (2) bosonic symmetries as opposed to fermionic and (3) electromagnetic waves with completely vanishing fields on the edge unlike any known phase of matter till date. We outline strategies to search for such new non-local topological phases of atomic scale matter.

[1] Quantum gyroelectric effect: Photon spin-1 quantization in continuum topological bosonic phases
Todd Van Mechelen and Zubin Jacob
Phys. Rev. A 98, 023842

Notes

A2

Topological One-way Fibers

Ling Lu 陆凌

Institute of Physics, Chinese Academy of Sciences, Beijing, China

Abstract: Topological photonics started with the realization of one-way edge waveguides as the analog of chiral edge states of the 2D Chern insulator (or the 2D quantum Hall effect), where the number and direction of 1D edge modes are determined by the 2D bulk topological invariant: the first Chern number (C_1). 3D bands of nonzero C1 have also been realized in Weyl photonic crystals, opening doors to 3D topological phases for photons. Here we show that, by annihilating a single pair of Weyl points with helix modulations, light can be guided unidirectionally in the core of 3D photonic crystal fibers where the number and direction of one-way modes equals the magnitude and sign of the second Chern number (C_2) — the topological invariant of complex vector bundles on 4D manifolds. This novel approach to create the line-defect states in the 3D topological bandgap provides a definitive way to obtain arbitrary mode number ($C_2 = -\infty$ to $+\infty$) in the one-way fibers by varying the helix frequencies. Furthermore, all the modal dispersions have almost identical group and phase velocities, superior for multimode operations. This proposal is realizable at microwave frequencies.

Ling Lu is a professor in the Institute of Physics of Chinese Academy of Sciences in Beijing China. He obtained his bachelor in Physics in 2003 from Fudan University in Shanghai, China. He got his Ph.D. in Electrical Engineering in 2010 at University of Southern California in Los Angeles. His experimental thesis work, advised by Prof. John O'Brien, was on photonic crystal nanocavity lasers. He was a postdoc and later a research scientist in the Physics Department of Massachusetts Institute of Technology, where he worked with Prof. Marin Soljačić and John Joannopoulos and collaborated with Prof. Liang Fu. His current research focuses on topological photonics. http://linglu.info

Notes

A3

Topological Spoof-plasmon Polaritons for Robust Waveguiding at the Subwavelength Scale

Romain Fleury

EPFL

Abstract: Spoof-plasmon polaritons are deeply confined surface waves propagating over a two-dimensional arrangement of subwavelength resonators. In this talk, I will show that it is possible to induce non-trivial topological properties for spoof-plasmon polaritons by tailoring the periodic structure of a 2D array of resonators, which allows for a new form of wave guiding mechanism at the subwavelength scale. I will also compare quantitatively the robustness of several topological designs to the one of conventional designs for different classes of defects, including position and frequency disorder, by performing ensemble averages over many defect realizations. This will highlight the clear practical advantages of topological designs over conventional ones for some classes of defects. I will provide experimental evidences for our findings in the microwave frequency range.

Notes

A4

Topological Photonics, Topological Insulator Lasers, etc

Moti Segev
Technion

I will introduce the new field of Topological Photonics, describe the recent invention of Topological Insulator Lasers, and present new ideas.

Notes

B1

New Materials and Applications for Metasurfaces & 4D Photonics

Vladimir M. Shalaev
School of Electrical & Computer Engineering and Birck Nanotechnology Center, Purdue University

Abstract: The fields of nanophotonics and plasmonics enabled unprecedented ways to control the flow light at the nanometer scale. In this presentation, novel emerging plasmonic concepts and material platforms will be discussed with the focus on practical photonic technologies.

Notes

B2

Nonreciprocal Nanophotonics with Dielectric and Plasmonic Metasurfaces

Jennifer Dionne, Mark Lawrence, David Barton

Stanford University
496 Lomita Mall, Stanford, CA 94305

Abstract: The propagation of free-space electromagnetic signals is generally governed by time-reversal symmetry, meaning that forward- and backward-travelling waves will trace identical paths when being reflected, refracted or diffracted at an interface. Breaking time-reversal symmetry promises significantly improved photo-voltaic efficiencies and optical diodes, but is challenging to achieve in compact optical devices. Here, we introduce two nanophotonic designs that enable nonreciprocal transmission of visible and near infrared light within subwavelength optical paths.

First, we show that the Kerr effect, in which the refractive index depends on the local light intensity, can produce passive directional transmission. In this case, slight structural asymmetries lead to a directionally dependent field enhancement and, consequently, a directional Kerr shift of the resonant dip. We achieve nonreciprocal transmission for silicon films as thin as 100nm with incident powers of a few kW/cm^2. We additionally show a nonreciprocal Kerr shift in a phase gradient metasurface, making nonreciprocal beemsteering and lensing possible. Secondly, we also propose the use of stimulated Raman scattering (SRS) to achieve power independent nonreciprocity. By pumping a 4-fold rotationally symmetric metasurface with circularly polarized light, detuned appropriately from a high Q resonance, SRS is shown to occur only when a circularly polarized probe beam is incident from one direction. Subsequently, nonreciprocal electromagnetic-induced transparency is observed in the resonant transmission spectrum. Unlike previous demonstrations of phonon mediated optical biasing, this effect exploits atomic scale vibrations and so, in principle, has no lower bound on the size of a device. Combined, these platforms enable time-reversal-symmetry breaking for arbitrary free-space and modal optical inputs in a simple, robust materials platform.

Notes

B3

Plasmonics: Friend or Foe for Laser Miniaturization?

Ren-Min Ma*

* *State Key Lab for Mesoscopic Physics and School of Physics, Peking University, Beijing 100871, China*
renminma@pku.edu.cn

Abstract: In 2003, David J. Bergman and Mark I. Stockman proposed the concept of a spaser as an amplifier of localized surface plasmons oscillating in metal, which has recently been generalized to include surface plasmon polariton amplifiers. In conventional semiconductor lasers, metal contacts are usually located far from light emission regions and the cavity mode to prevent parasitic absorption, so the idea of using metals within the laser cavity was unconventional. Since the first proposal for plasmonic nanolasers, there has been a debate about the limitations on their performance posed by the inherent losses in metallic systems. In this talk, we present plasmonic nanolasers with record low thresholds on the order of 10 KW cm^{-2} at room temperature, which are comparable to those found in modern laser diodes. We systematically study key parameters of over 200 nanolasers, including physical size, threshold, power consumption and lifetime and analyze these to determine a set of laws that show how these parameters scale against each other. These scaling laws suggest that plasmonic lasers can be more compact, faster with lower power consumption than photonic nanolasers when the cavity size approaches or surpasses the diffraction limit. We then assess the intrinsic merits of nanolasers and review recent progress on their application, particularly in the directions of optical interconnects, near-field spectroscopy and sensing, and novel far field beam synthesis through near field eigenmode engineering.

Notes

B4

Semiconductor Nanolasers: From Plasmonic Confinement to 2D Monolayer Gain Media

Cun-Zheng Ning
International Center for Nano-Optoelectronics, Tsinghua University, Beijing, China
Department of Electronic Engineering, Tsinghua University, Beijing, China
School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

Abstract: Reducing the confinement dimensions of photons and electrons to ever lower dimensionality or smaller scales has been a fruitful approach in revealing many important phenomena of light-matter interaction. Technologically such dimensionality reduction has resulted in unprecedented miniaturization of semiconductor lasers into the nano-regime (nanolasers), especially with the incorporation of plasmonic confinement. Plasmonic nanolasers or SPASERs represents a possible paradigm shift in laser design and miniaturization beyond diffraction limit. Nanolasers could be potentially important for a wide range of applications, particularly for on-chip interconnects.

This talk will start with the basic physics and applications of nanolasers including the major progress made over the last 10 years. More importantly, we will discuss major issues and possible solutions for the future. While efforts in the past have been mostly focused on confining photons, it is equally important to constantly search for better gain materials. In this regard, we will discuss some of the recent work on utilizing 2D transition metal dichalcogenide (TMDC) materials as potentially important gain materials. Even though laser demonstrations have been reported, the existence and origin of optical gain remains a mystery for 2D materials. We will present some of our recent spectroscopic studies of exciton complexes in 2D materials and identify possible correlation with existence and origin of optical gain in such 2D materials.

Notes

Plenary Talk 2

Soft meta-materials: self-gauged assembly, non-equilibrium matters, and 3D super-resolution imaging

Xiang Zhang
(University of Hong Kong)

Notes

C1

Mie-resonant All-dielectric Nanophotonics and Meta-optics

Yuri Kivshar

Nonlinear Physics Center, Australian National University, Canberra, Australia

Abstract: Metamaterials---artificial electromagnetic media that are structured on the subwavelength scale---were initially suggested for the realisation of negative-index media, and later they became a paradigm for engineering electromagnetic space and control¬ling propagation of waves. However, applications of metamaterials in optics are limited due to inherent losses in metals employed for the realisation of artificial optical magnetism. Recently, we observe the emergence of a new field of all-dielectric resonant meta-optics aiming at the manipulation of strong optically-induced electric and magnetic Mie-type resonances in dielectric and semiconductor nanostructures with relatively high refractive index. Unique advantages of dielectric resonant nanostructures over their metallic counterparts are low dissipative losses and the enhancement of both electric and magnetic fields that provide competitive alternatives for plasmonic structures including optical nanoantennas, efficient biosensors, passive and active metasurfaces, and functional metadevices. This talk will summarize the most recent advances in all-dielectric Mie-resonant meta-optics including active nanophotonics as well as the recently emerged fields of topological photonics and nonlinear metasurfaces.

Notes

C2

Metalens for Imaging and Sensing

Ren Jie Lin[1], Vin-Cent Su[2], Shuming Wang[3,4], Mu Ku Chen[1], Tsung Lin Chung[1], Yu Han Chen[1], Hsin Yu Kuo[1], Jia-Wern Chen[1], Ji Chen[3,4], Yi-Teng Huang[1], Cheng Hung Chu[5], Pin Chieh Wu[5], Tao Li[3,4], Zhenlin Wang[3,4], Shining Zhu[3,4], Din Ping Tsai[1,5*]

[1] Department of Physics, National Taiwan University, Taipei 10617, Taiwan
[2]Department of Electrical Engineering, National United University, Miaoli 36063, Taiwan
[3]National Laboratory of Solid State Microstructures, College of Engineering and Applied Sciences, School of Physics, Nanjing University, Nanjing 210093, China
[4]Collaborative Innovation Center of Advanced Microstructures, Nanjing 210093, China
[5]Research Center for Applied Sciences, Academia Sinica, Taipei 11529, Taiwan

[*]Author email address: dptsai@sinica.edu.tw

Abstract: Most recent research on the metalens imaging and sensing will be presented in this talk. Many flat optical devices have been demonstrated using metalens lately. For applications of full-color imaging and detections, the correction of chromatic aberration is a key issue. The optical dispersion of resonance-based nanoantennas and the composition materials hinders the realization of an achromatic metalens, especially for the ones working in the visible spectrum. Recently, we introduce the integrated-resonant unit elements to incorporate with geometric phase method to realize achromatic metasurfaces. Broadband metalenses working over the near-infrared in reflection and entire visible spectrum in a transmission scheme are achieved, respectively. The average efficiency of gallium nitride (GaN) achromatic metalens with a numerical aperture of 0.106 is about 40%. Demonstration of full-color imaging and sensing using GaN achromatic metalens has been successfully achieved. A pixel-level color router through metasurface design, which is capable of guiding individual primary wavelengths into different spatial positions, and a functionality of selectively specific narrow bandwidth for light routing is shown as well. The function of multiplex color routing is theoretically and experimentally realized. Structural design of dispersion-engineered metasurfaces are expected to have numerous applications in the future light-based and optical technologies. Imaging and sensing, tomography, and high dimensional quantum information by metalens will be discussed.

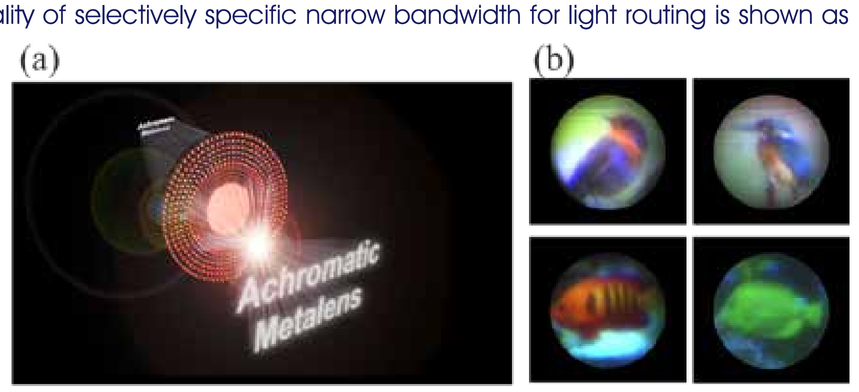


Figure 1. (a) Achromatic metalens, (b)Full-colour images captured by achromatic metalens.

References

[1] S. M. Wang, P. C. Wu, V.-C. Su, Y.-C. Lai, M.-K. Chen, H. Y. Kuo, B. H. Chen, Y. H. Chen, T.-T. Huang, J.-H. Wang, R.-M. Lin, C.-H. Kuan, T. Li, Z. L. Wang, S. N. Zhu & D. P. Tsai, Nature Nanotechnology 13, 227–232 (2018)
[2] S. M. Wang, P. C. Wu, V.-C. Su, Y.-C. Lai, C. H. Chu, J.-W. Chen, S.-H. Lu, J. Chen, B. B. Xu, C.-H. Kuan, T. Li, S. N. Zhu, and D. P. Tsai, Nature Communication 8, 187 (2017)

Notes

C3

Nanophotonic of Super Oscillations: Imaging and Metrology Applications

Nikolay I. Zheludev
University of Southampton, UK & NTU Singapore

Abstract: There are remarkable similarities between rapidly varying free-space electromagnetic fields known as super-oscillations and the evanescent fields of plasmonic nanostructures. We show how phase singularities, energy nano-vortices and energy backflow of light in the free space can lead to the ability of a metamaterial mask to form in free space the light foci of arbitrary small size. Finally, show how super-soscillatory fields can be used in nanoscale imaging and metrology.

Notes

D1

New Opportunities with an Old Material

Marko Lončar

John A. Paulson School of Engineering and Applied Science, Harvard University, Cambridge, MA 02138, USA
loncar@seas.harvard.edu

Abstract: Lithium niobate (LN) is an "old" material with many applications in optical and microwave technologies, owing to its unique properties that include large second order nonlinear susceptibility, large piezoelectric response, and wide optical transparency window. Conventional LN components, including modulators and periodically polled frequency converters, have been the workhorse of the optoelectronic industry. They are reaching their limits, however, as they rely on weakly guiding ion-diffusion defined optical waveguides in bulk LN crystal. I will discuss our efforts aimed at the development of integrated LN platform [1, 2], featuring sub-wavelength scale light confinement and dense integration of optical and electrical components (Figure 1). Examples of devices to be discussed include integrated LN electro-optic modulators that can be driven directly by a CMOS circuit [3] and ultra-high Q LN optical cavities (Figure 1a, b) [4] with application in electro-optic and Kerr frequency combs (Figure 1c-e). Finally, various approaches to perform nonlinear wavelength conversion in LN waveguides will be discussed [5-6].

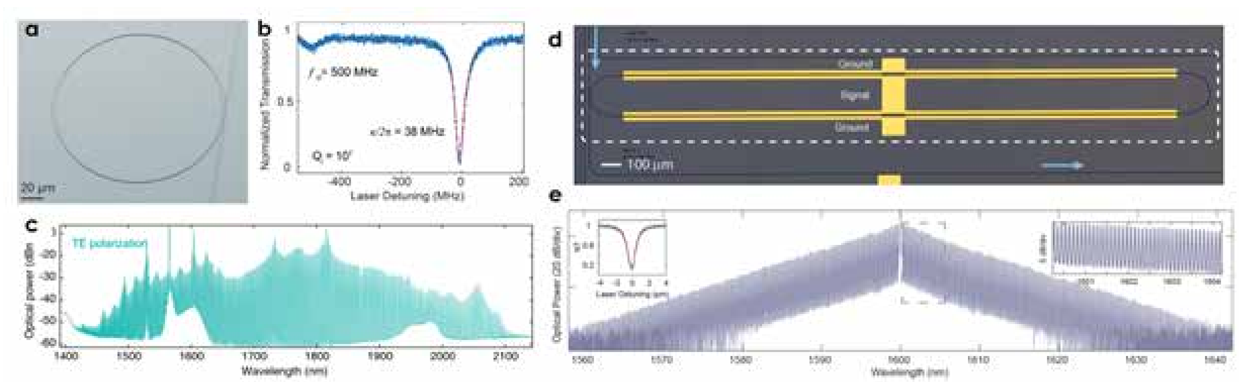


Figure 1. Low loss integrated LN photonic platform. (a) Ring resonator featuring (b) Q ~ 10,000,000. Using these devices (c) Kerr frequency combs have been realized, covering ~ 700 nm wavelength range (FSR = 250 GHz; optical power in the buss waveguide: ~ 300 mW). (d) Electro-optic frequency comb based on LN race-track resonator integrated with microwave electrodes. (e) Output spectrum of the EO comb featuring FSR ~ 10 GHz, > 80 nm bandwidth and 1 dB/nm slope (input optical power).

1.C. Wang, M. J. Burek, Z. Lin, H. A. Atikian, V. Venkataraman, I. Huang, P. Stark, and M. Lončar, "Integrated high quality factor lithium niobate microdisk resonators", Opt. Express, 22, 30924 (2014)
2.C. Wang, M. Zhang, B. Stern, M. Lipson, and M. Loncar, "Nanophotonic Lithium Niobate Electro-optic Modulators." Optics Express, 26, 1547 (2017).
3.M. Zhang, C. Wang, X. Chen, M. Bertrand, A. Shams-Ansari, S. Chandrasekhar, P. Winzer, and M. Lončar, "Ultra-High Bandwidth Integrated Lithium Niobate Modulators with Record-Low Vπ", OFC, San Diego, CA (11−15 March 2018), post-deadline paper Th4A.5 (DOI: 10.1364/OFC.2018.Th4A.5)
4.M. Zhang, C. Wang, R. Cheng, A. Shams-Ansari, and M. Loncar, "Monolithic Ultrahigh-Q Lithium Niobate Microring Resonator." Optica, 4, 1536 (2017).
5.C. Wang, Z. Li, M. H. Kim, X. Xiong, X. F. Ren, G. C. Guo, N. Yu, and M. Loncar, "Metasurface-assisted phase-matching-free second harmonic generation in lithium niobate waveguides", Nature Communications, 8, 2098, (2017)
6.C. Wang, X. Xiong, N. Andrade, V. Venkataraman, X. F. Ren, G. C. Guo, and M Lončar, "Second harmonic generation in nano-structured thin-film lithium niobate waveguides", Optics Express, 6, 6963 (2017)

Notes

D2

Integrated Quantum Photonics: Qantum Emitters, Detectors and Circuits

V. Zwiller[1,2,3], A. W. Elshaari1, L. Schweickert1, K. D. Jöns[1], T. Lettner1, K. D. Zeuner[1], J. Zichi[1,2], S. Gyger[1], E. Schön[1], A. Fognini[2,1], Esmaeil Zadeh[2], S. Dobrovolskiy[3], R. Gourgues[3], J. W. N. Los[3], G. Bulgarini[3] and S. Dorenbos[3]

[1]Department of Applied Physics, KTH, Stockholm, Sweden
[2]Kavli Institute of Nanoscience, TU Delft, The Netherlands
[3]Single Quantum, Delft, The Netherlandsi
E-mail: zwiller@kth.se

Abstract: With the aim of realizing complex quantum networks, we develop quantum devices based on nanostructures to generate quantum states of light with semiconductor quantum dots, single photon detectors based on superconducting nanowires and on-chip circuits based on waveguides to filter and route light.

The generation of single photons can readily be performed with single quantum dots. We demonstrate a very high single photon purity exceeding 99.99% generated at 795 nm with GaAs quantum dots [1], these quantum emitters also allow for interfacing with atomic ensembles. To enable long distance communication, we are also developing devices based on single InAs quantum dots able to emit at telecom frequencies [2].

Quantum entanglement is an important resource for quantum technologies, we will demonstrate generation of entanglement with quantum dots and discuss the limits to fidelity with the biexciton-exciton cascade [3].

To allow for complex architectures, on-chip integration is required. We demonstrate filtering and routing of single photons with tunable ring resonators on a chip and discuss the scalability of this approach [4].

Generation and manipulation of quantum states of light would be useless without single photon detectors. We are therefore developing high-performance single photon detectors based on superconducting nanowires and will present state-of-the-art performance in terms of detection efficiency, low dark counts and time resolution [5].

References

[1]L. Schweickert et al., On-demand solid-state single-photon source with 99.99% purity, Appl. Phys. Lett. 112, 093106 (2018).
[2]K. D. Zeuner et al., A stable wavelength-tunable triggered source of single photons and cascaded photon pairs at the telecom C-band, Appl. Phys. Lett. Accepted (2018).
[3]A. Fognini et al., Path to perfect photon entanglement with a quantum dot, arXiv:1710.10815 (2017).
[4]A. W. Elshaari et al., On-chip single photon filtering and multiplexing in hybrid quantum photonic circuits, Nat. Commun. 8, 379 (2017).
[5]I. Esmaeil Zadeh et al., Single-photon detectors combining ultra-high efficiency, detection-rates, and timing resolution, APL Photonics 2, 111301 (2017).

Notes

D3

Quantum optics and information science in multi-dimensional photonics Networks

Christine Silberhorn
Integrated Quantum Optics, Department Physics, Paderborn University

Abstract: Classical optical networks have been widely used to explore a broad range of transfer phenomena based on coherent interference of waves, which relate to different disciplines in physics, information science, and even biological systems. At the quantum level, the quantized nature of light, this means the existence of photons and entangled states, gives rise to genuine quantum effects that can appear completely counter-intuitive. Yet, to date, quantum network experiments typically still remain rather limited in terms of the number of photons, reconfigurability and, maybe most importantly, network size and dimensionality.

Photonic quantum systems, which comprise multiple optical modes as well as highly nonclassical and sophisticated quantum states of light, have been investigated intensively in various theoretical proposals over the last decades. However, their implementation requires advanced setups of high complexity, which poses a considerable challenge on the experimental side. The successful realization of controlled quantum network structures is key for many applications in quantum optics and quantum information science.

Here we present three differing approaches to overcome current limitations for the experimental implementation of multi-dimensional quantum networks: non-linear integrated quantum optics, pulsed temporal modes and time-multiplexing. Non-linear integrated quantum devices with multiple channels enable the combinations of different functionalities, such as sources and fast electro-optic modulations, on a single compact monolithic structure. Pulsed photon temporal modes are defined as field orthogonal superposition states, which span a high dimensional system. They occupy only a single spatial mode and thus they can be efficiently used in single-mode fibre communication networks. Finally, time-multiplexed quantum walks are a versatile tool for the implementation of a highly flexible simulation platform with dynamic control of the underlying graph structures and propagation properties.

Notes

Plenary Talk 3

Integrated $\chi^{(2)}$ Photonics

Hong Tang

Department of Electrical Engineering, Yale University

Abstract: The ability to generate and manipulate photons with high efficiency and coherence is of critical importance for both fundamental quantum optics studies and practical device applications. However mainstream integrated photonic platforms such as those based on silicon and silicon nitride lack the preferred cubic $\chi^{(2)}$ nonlinearity, which limits active photon control functionalities. In this talk, I will present integrated photonics based on aluminum nitride (AlN), whose wurtzite crystal structure gives rise to the strong second-order optical nonlinearity and piezoelectric effect. Together with its low optical and mechanical losses, the integrated AlN photonics can provide enhanced $\chi^{(2)}$ photon-photon interactions to achieve high fidelity photon control, including on-chip parametric down-conversion, coherent light conversion, spectral-temporal shaping, and microwave-to-optical frequency conversions.

Notes

E1

Dynamic Optical Metasurfaces

Jason Valentine

Department of Mechanical Engineering, Vanderbilt University, Nashville, Tennessee 37212, USA

Abstract: The recent development of metasurfaces has provided new routes for the manipulation of the wavefront, polarization, and momentum of light. There has recently been much interest in dynamic metasurfaces with properties that can be modulated in real-time. Such metasurfaces could open the door to several fascinating applications including dynamic beam forming, polarization control, lenses, spectral control, and free-space modulators. Many approaches are being considered for gaining active control over metasurfaces but there is often a tradeoff between modulation depth and the energy required for modulation. In this talk, I will discuss our recent efforts to reduce the energy required for metasurface modulation while still preserving large modulation depth. These approaches utilize several different modulation mechanisms including carrier modulation and phase change media.

Notes

E2

Synthetic Interface Optics: Two Two-dimensional Surfaces Better than One

C.W. Qiu

Department of Electrical & Computer Engineering, National University of Singapore, Singapore 117583
**E-mail: chengwei.qiu@nus.edu.sg*

Abstract: Interfacial engineering via the artificially constructed structures of ultrathin thickness compared to the wavelength has enabled a plethora of advanced manipulations of light-matter interactions. In particular, the low-dimension and high-frequency scaling may promise a lot more interesting applications, while the challenges in design principle and fabrication capability will become critical limits. I will report some of the most recent developments in my group as well as in the field of the interfacial engineering of manipulation of light-matter interactions, at synthetic interfaces composed of artificially structured surfaces with natural 2D materials. I will show how to use this roadmap to significantly enhance the information capacity, beam steering efficiency, photoluminescence, second harmonic generations, and nonlinear chiral valley photons, etc, when 2D materials meet metasurfaces. Our work paves a roadmap to design sophisticated linear, nonlinear, and quantum photonics as well as valleytronic nanodevices.

Notes

E3

Microresonator Soliton Frequency Combs

Tobias J. Kippenberg
EPFL, Switzerland

Abstract: Optical frequency combs1,2 provide equidistant markers in the IR, visible and UV and have become a pivotal tool for frequency metrology and are the underlying principle of optical atomic clocks, but are also finding use in other areas, such as broadband spectroscopy or low noise microwave generation. In 2007 a new method to generate optical combs was discovered based on high Q optical microresonators3,4. Such microresonator frequency combs have since then emerged as a new and widely investigated method with which combs can be generated via parametric frequency conversion of a continuous wave (CW) laser inside a high Q resonator via the Kerr nonlinearity. Over the past years the a detailed understanding of the comb formation process has been gained, and regimes identified in which dissipative temporal solitons (DKS) can be generated, that not only provide low noise optical frequency combs but moreover give access to femtosecond pulses. Such DKS have unlocked the full potential of soliton micro-combs by providing access to fully coherent and broadband combs and soliton broadening effects. Dissipative Kerr solitons have now been generated in a wide variety of resonators, including those compatible with photonic integration based on silicon nitride (Si3N4). We will discuss the DKS regime, first discovered in crystalline resonators, and our current understanding including the observation of the breather soliton regime, the influence of avoided mode crossings on breather and the repetition rate, as well as methods to deterministically access the single soliton regime. Taken together this has enabled to reliably access single soliton states in photonic chip based resonators, in particular those utilizing the photonic damascene process. Dissipative Kerr solitons enable to obtain combs that can span more than a full octave using soliton induced Cherenkov radiation, which extends the combs bandwidth and power in the spectral wings via dispersive waves. Such DKS have been enabled to count the cycles of light, allow 2f-3f self referencing. Using such soliton Kerr optical frequency combs in a SiN microresonator we have recently demonstrated with the group of C. Koos (KIT) massively parallel coherent communication, with dual combs for both the source and as massively parallel LO for the coherent receiver1. Moreover, we have demonstrated using a pair of photonic chip based frequency combs dual comb distance measurements, with record acquisition rates due to the combs large mode spacing (100 GHz). Recent work moreover has shown that DKS can be extended to the biological imaging window at 1 micron, relevant for e.g. Raman spectral imaging or OCT. Soliton microcombs have the potential to advance timekeeping, metrology or telecommunication by providing a technology amenable to full photonic integration, low power consumption and large comb bandwidth and repetition rate.

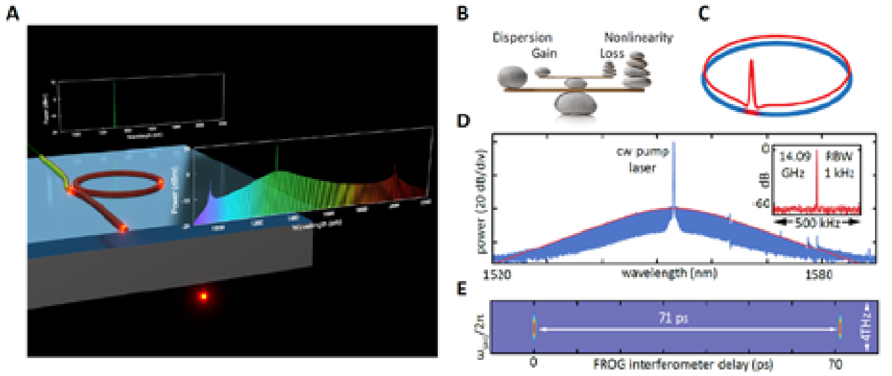


Figure 1 : Dissipative Kerr solitons in microresonators. (B) Principle of a DKS that balances dispersion and nonlinearity, as well as parametric gain and cavity loss. (C) temporal dissipative soliton waveform envelope in a microresonator (D) First demonstration of a DKS in a crystalline microresonator. (E) The FROG profile of a single DKS.

1 Cundiff, S. T. & Ye, J. Colloquium: Femtosecond optical frequency combs. Rev. Mod. Phys. 75, 325-342 (2003).
2 Udem, T., Holzwarth, R. & Hansch, T. W. Optical frequency metrology. Nature 416, 233-237 (2002).
3 Del Haye, P. et al. Optical frequency comb generation from a monolithic microresonator. Nature 450, 1214 (2007).
4 Kippenberg, T. J., Holzwarth, R. & Diddams, S. A. Microresonator-based optical frequency combs. Science 332, 555-559, doi:10.1126/science.1193968 (2011).
5 Del'Haye, P. et al. Octave Spanning Tunable Frequency Comb from a Microresonator. Physical Review Letters 107, doi:10.1103/PhysRevLett.107.063901 (2011).
6 Herr, T. et al. Universal formation dynamics and noise of Kerr-frequency combs in microresonators. Nature Photonics 6, 480-487, doi:10.1038/nphoton.2012.127 (2012).
7 Alnis, J. et al. Thermal-noise-limited crystalline whispering-gallery-mode resonator for laser stabilization. Physical Review A 84, doi:10.1103/PhysRevA.84.011804 (2011).
8 Kudryashov, A. V. et al. Terabit/s data transmission using optical frequency combs. 8600, 860009, doi:10.1117/12.2003701 (2013).
9 Wang, C. Y. et al. Mid-infrared optical frequency combs at 2.5 mum based on crystalline microresonators. Nature communications 4, 1345, doi:10.1038/ncomms2335 (2013).10 Herr, T. et al. Temporal solitons in optical microresonators. Nature Photonics 8, 145-152, doi:10.1038/nphoton.2013.343 (2013).

Notes

F1

Lithium Niobate Based Quantum Photonic Chips

Ping Xu

Nanjing University and National University of Defense Technology

Abstract: In this talk, we will mainly report the generation and manipulation of entangled photons from periodically poling LN bulk crystal wafer and the LN waveguide circuits chip, respectively. The generated entangled photons can been controlled with full degrees of freedom offered by the versatile design of domain structures in bulk crystal, resulting in new types of photonic entanglement and new quantum effects such as two-photon focusing, active quantum beam-splitting. Meanwhile, by introducing the periodically poling structure into into LN waveguide circuits, we demonstrate the on-chip continuous morphing from two-photon separated state to bunched state, highly integrated polarization entanglement, heralded photon-number state, tailored triplets etc.. The LN chips show advantages in low-energy cost, flexible high-flux photon sources, fast and efficient electro-optic (EO) modulators as well as reconfigurable waveguide circuits, which indicates wide applications in quantum communication and quantum computing. In the end of the talk we will give a brief review of several material platforms for quantum photonic chips including LN, SOI etc. The key parameters of several types of material platforms are listed and compared.

Notes

F2

Toward Quantum Supremacy Using Solid-state Single Photons

Chao-Yang Lu
University of Science and Technology of China, Hefei, P.R. China
cylu@ustc.edu.cn

Abstract: We develop single-photon sources that simultaneously combines high purity, efficiency, and indistinguishability. We demonstrate entanglement among ten single photons. We construct high-performance multi-photon boson sampling machines to race against classical computers.

Boson sampling is considered as a strong candidate to demonstrate the "quantum advantage / supremacy" over classical computers. However, previous proof-of-principle experiments suffered from small photon number and low sampling rates owing to the inefficiencies of the single-photon sources and multi-port optical interferometers. In this talk, I will report two routes towards building Boson Sampling machines with many photons.

In the first path, we developed SPDC two-photon source with simultaneously a collection efficiency of ~70% and an indistinguishability of ~91% between independent photons. With this, we demonstrate genuine entanglement of ten photons [1]. Very recently, we managed to observe 12-photon entanglement using an optimal SPDC source. Such a platform will provide enabling technologies for teleportation of multiple properties of photons [2] and efficient scattershot boson sampling.
In the second path, using a QD-micropillar, we produced single photons with high purity (>99%), near-unity indistinguishability for >1000 photons [3], and high extraction efficiency [4]—all combined in a single device compatibly and simultaneously. We build 3-, 4-, and 5-bosonsampling machines which runs >24,000 times faster than all the previous experiments, and for the first time reaches a complexity about 100 times faster than the first electronic computer (ENIAC) and transistorized computer (TRADIC) [5,6]. We are currently increasing the rate by optimizing the single-photon system efficiency to near unity using elliptical micropillars, background-free resonance fluorescence using two color excitation, and using improved schemes such as boson sampling with photon loss [7], with the hope of achieving 20-photon boson sampling in the near term.

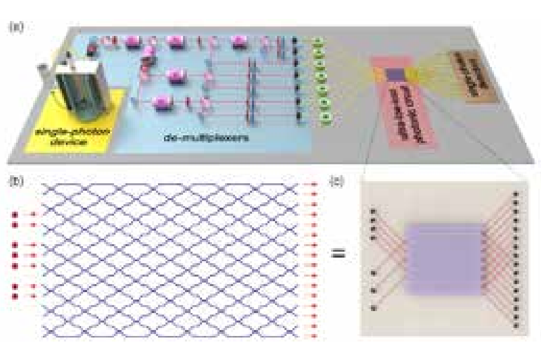


*Figure 1: Experimental setup for boson sampling with 7 input single photons into an ultra-low-loss 16*16 interferometer. Quantum dot single photon extraction (system) efficiency is 82% (34%). Photon indistinguishability 94% (90%) at time separation of 13 ns (15 μs). Three-photon count rate ~80 KHz.*

[1] X.-L. Wang et al. Experimental ten-photon entanglement, Phys. Rev. Lett. 117, 210502 (2016).
[2] X.-L. Wang et al. Quantum teleportation of multiple degrees of freedom of a single photon, Nature 518, 516 (2015).
[3] H. Wang et al. Near transform-limited single photons from an efficient solid-state quantum emitter, Phys. Rev. Lett. 116, 213601 (2016).
[4] X. Ding et al. On-demand single photons with high extraction efficiency and near-unity indistinguishability from a resonantly driven quantum dot in a micropillar, Phys. Rev. Lett. 116, 020401 (2016).
[5] H. Wang et al. Multi-photon boson-sampling machines beating early classical computers, Nature Photonics 11, 361 (2017)
[6] Y. He, et al. Time-bin-encoded boson sampling with a single-photon device, Phys. Rev. Lett. 118, 190501 (2017)
[7] H. Wang et al. Toward scalable boson sampling with photon loss, Phys. Rev. Lett. 120.230502 (2018)

Notes

F3

Advances in Monolithic Quantum Photonics for Sensing

Amr S. Helmy

The Department of Electrical and Computer Engineering, University of Toronto

Abstract: This talk will describe a technology that enables the utilization of second order nonlinearities, ? (2) in monolithic semiconductors to be used as an optimal tool box for quantum optics. This approach uses dispersion engineering in Bragg reflection waveguides to harness parametric processes to produce non classical sources through down conversion [1-4]. These can also be realized in conjunction with concomitant dispersion and birefringence engineering in active devices such as semiconductor diode lasers [5-9]. On the classical front, the technology enables novel coherent light sources using frequency conversion in a self pumped chip-form factor.

Novel sources for non-classical states of photons in this monolithic platform will be reviewed. These chip-based sources can afford the integration of other devices such as laser pump sources, power and polarization splitters, gates, cavities and much more. This platform essentially offers the capability of transferring current quantum optical setups from the optical table in a lab into a practical realm and even the market place.

Also in this talk, some of the application that utilize the aforementioned sources will be discussed, including monolithic photonics architectures that enable deterministic splitting of entangled states of light will be discussed. In addition, sources for target detection and sensing protocols such as quantum illumination in integrated architectures will be also presented. The attributes of this platform offer unique opportunities in metrology applications where size, power, form-factor and space qualification are important factors.

[1] A. Brodutch, R. Marchildon, Amr S. Helmy, Dynamically Reconfigurable Sources for Arbitrary Gaussian States in Integrated Photonic
Circuits, Opt Exp. Vol. 26, pp. 17635-17648 (2018).
[2] Z. Leger, A. Brodutch, Amr S. Helmy, Entanglement enhancement in multimode integrated circuits, Phys. Rev. A, Vol. 97, 062303, (2018).
[3] Simon Axelrod, Mohsen Kamandar Dezfouli, Herman M. K. Wong, Amr S. Helmy, and Stephen Hughes Hyperbolic metamaterial nanoresonators make poor single-photon sources, Phys. Rev. B 95, 155424, April 2017.
[4] Dongpeng Kang, A. Anriban, A. S. Helmy "Polarization entanglement diversity in monolithic semiconductor waveguides," Opt Exp. 24, pp 15160-15170. (2016).
[5] C. Lin, R. Grassi, T. Low Amr S. Helmy. "Multilayer black phosphorus as a versatile mid-infrared electro-optic material" ACS Nano Lett. 5, 12313 (2016).
[6] R. Marchildon Amr. S. Helmy, "Dispersion-enabled quantum state control in photonics," OSA Optica, Vol. 3, No. 3 2334-2536, 2016.
[7] P. Chen, C Lin and Amr. S. Helmy "Polarization Engineering in Nanoscale Waveguides Using Lossless Media," IEEE J. Lght. Technolo.,
vol.34, pp 952-960, 2016.
[8] R. Marchildon and Amr. S. Helmy, "Deterministic separation of arbitrary photon pair states in integrated quantum circuits," Laser Photonics Rev., 1–12 (2016) DOI 10.1002/lpor.201500133.
[9] Amr S. Helmy "Breakthroughs in Photonics 2013: Electrically Pumped Semiconductor Entangled Sources," IEEE Phot. Jrnl., 6, issue
2, 700206 (2014).

Notes

Plenary Talk 4

Functional Waves

Nader Engheta

University of Pennsylvania
Philadelphia, PA 19104, USA
Email: engheta@ee.upenn.edu
Web: www.seas.upenn.edu/~engheta/

Abstract: Materials are often used to manipulate waves. Metamaterials have provided far-reaching possibilities in achieving "extremes" in such wave-matter interaction. Various exciting functionalities have been achieved in exploiting metamaterials and metasurfaces in nanophotonics and nano-optics. We have been exploring how extreme metamaterials can give us new platforms for exploiting waves to do certain useful functions for us. Several scenarios are being investigated in my group. As one scenario, we have been developing metastructure platforms that can solve integral equations with waves as waves interact with them. Such "metamaterial machines" can function as wave-based analog computing machines, suitable for micro- and nanoscale integration. Another case study is the notion of 4-dimensioanl metamaterials, in which temporal variation of material parameters, in addition to (and/or in place of) their spatial variation, can open doors to exciting new wave-based features. In this talk, I will present some of our ongoing work on material platforms that offer us "functional waves", and will forecast possible future research directions in these paradigms.

Notes

G1

Hot Electrons in Electrically-driven Plasmonic Nanostructures

Anatoly V Zayats

Department of Physics and London Centre for Nanotechnology, King's College London, Strand, London WC2R 2 LS, United Kingdom

Abstract: Plasmonically-derived hot carriers have recently emerged as a powerful means to harvest excited electrons in metallic nanostructures and put them into use for catalysis, chemical reaction stimulation and improvement of optoelectronic devices. In this talk, we will discuss the differences between optically and electrically excited hot electrons, dynamics of hot-electron excitations in plasmonic nanostructures and their applications in promoting chemical reactions. In particular, the excitation of surface plasmons and hot electrons in electrically-driven metamaterials will be discussed. These electronic excitations activate reactive tunnel junctions, enabling reversible oxidization and reduction chemical transformations. In addition, the opportunities for developing tunnelling-based nanoscale plasmonic and light sources as well as ultra-sensitive sensors will be considered. The electrically-driven plasmonic nanorod metamaterials provide a fertile platform merging electronics, photonics, and chemistry for studying and manipulating hot electrons, plasmons, and photons at the nanoscale and opens up the potential for designing chemical reactions, stimulated with hot electrons, and monitoring chemical processes for drug and materials discovery.

Notes

G2

Exploration of Light Detection and Modulation with Graphene-Like Layered Materials

Jian-Bin Xu[1,2]
[1]Department of Electronic Engineering and Materials Science and Technology Research Center
The Chinese University of Hong Kong, Shatin, Hong Kong SAR, China
[2]Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

jbxu@ee.cuhk.edu.hk

Abstract: Two-Dimensional (2D) layered materials show exceptionally unique electronic, optical, and mechanical, and thermal properties. In the past decade, great efforts have been devoted to the family of graphene-like layered materials and their heterostrcutres, and advances in optoelectronic devices based on graphene-like layered materials have been significantly accomplished, which shed light on the possible applications, specifically from visible to terahertz (THz) light waves. In this presentation, I will introduce our efforts in 2D layered materials and their heterostructures in the past decade or so. In order to substantially improve device performance, the device configuration of conventional graphene-based optoelectronic devices shall be meticulously interrogated, particularly in extending the interaction strength between graphene (or graphene-like material) and light beam over several orders of magnitude. In this talk, we share our novel design and fabrication of high-performance graphene-based optoelectronic devices (including photodetectors (from visible to the near-infrared regions) and THz modulators), by utilizing the extraordinary electronic and optic properties of graphene and its intrinsic transition effects. Similar strategies are also applicable to other graphene-like layered materials.

Acknowledgement: This work is made possibly via collaboration with Prof. X. R. Wang's group at Nanjing University, China, and Prof. E. Pickwell-MacPherson's group at CUHK. The work is in part supported by Research Grants Council of Hong Kong, particularly, via Grant Nos. AoE/P-03/08, T23-407/13-N, AoE/P-02/12, 14207515, 14204616, and CUHK Group Research Scheme.

[1] Z. F. Chen, J. B. Xu, et al., under review.
[2] X. M. Li, L. Tao, J. B. Xu, et al., Applied Physics Review 4, 021306, (2017)
[3] G. K. Zhao, X. M. Li, J. B. Xu, H. W. Zhu, et al., Chemical Society Review 47, 4417-449 (2017)
[4] Z. F. Chen, X. M. Li, J. B. Xu, et al., ACS Nano 11, 430-437 (2016)
[5] K. Chen, X. Wan, J. B. Xu, et al., ACS Nano 9, 9868-9876 (2015)
[6] Y. H. Zhang, J. S. Qiao, J. B. Xu, X. R. Wang, et al., Physical Review Letters 116, 016602 (2015)
[7] D. W. He, J. B. Xu, X. R. Wang et al., Science Advances 3, e1701186, (2017)
[8] D. W. He, Y. H. Zhang, J. B. Xu, X. R. Wang, et al., Nature Communications 5, 5162 (2014)
[9] X. D. Liu, Z. F. Chen, J. B. Xu, E. Pickwell-MacPherson, et al., Advanced Optical Materials 5, UNSP 1600697 (2017)
[10] Z. F. Chen, J. B. Xu, et al., Advanced Optical Materials 3, 1207-1214 (2015)

Notes

G3

Excited Carriers in Metals: From Icy Cold to Comfortably Warm to Scalding Hot

Jacob B Khurgin

Johns Hopkins University
jakek@jhu.edu

Abstract: The field of plasmonics in recent years has experienced a certain shift in priorities. Faced with undisputable fact that loss in metal structures cannot be avoided, or even mitigated (at least not in the optical and near IR range) the community has its attention to the applications where the loss may not be an obstacle, and, in fact, can be put into productive use. Such applications include photo-detection, photo-catalysis, and others where the energy of plasmons is expended on generation of hot carriers in the metal. Hot carriers are characterized by short lifetimes, hence it is important to understand thoroughly their generation, transport, and relaxation in order to ascertain viability of the many proposed schemes involving them.

In this talk we shall investigate the genesis of hot carriers in metals by investigating rigorously and within the same quantum framework all four principle mechanisms responsible for their generation: interband transitions, phonon-and-defect assisted intraband processes, carrier-carrier scattering assisted transitions and Landau damping. For all of these mechanisms we evaluate generation rates as well as the energy (effective temperature) and momenta (directions of propagation) of the generated hot electrons and holes. We show that as the energy of the incoming photons increases towards the visible range the electron-electron scattering assisted absorption becomes important with dire consequences for the prospective "hot electron" devices as four carriers generated in the process of the absorption of a single photon can at best be characterized as "lukewarm" or "tepid" as their kinetic energies may be too small to overcome the potential barrier at the metal boundary. Similarly, as the photon energy shifts further towards blue the interband absorption becomes the dominant mechanism and the holes generated in the d-shell of the metal can at best be characterized as "frigid" due to their low velocity. It is the Landau damping process occurring in the metal particles that are smaller than 10nm that is the most favorable on for production of truly "hot" carriers that are actually directed towards the metal interface.

We also investigate the relaxation processes causing rapid cooling of carriers. Based on our analysis we make predictions about performance characteristics of various proposed plasmonic devices.

Notes

H1

Photonic Integrated Circuits for Scalable Quantum Networks

Dirk Englund

MIT

Abstract: Photonic integrated circuits (PICs) have become increasingly important in classical communications applications over the past decades, including as transmitters and receivers in long-haul, metro and datacenter interconnects. Many of the same attributes that make PICs attractive for these applications — compactness, high bandwidth, and the ability to control large numbers of optical modes with high phase stability — also make them appealing for quantum information processing. The first part of this talk will review our recent progress in adapting one of the leading PIC architectures—silicon photonics—for various quantum secure communications protocols. The second part of the talk will describe how photonic integrated circuits technology can extend the reach of quantum communications through all-optical and memory-based quantum repeater protocols.

Notes

H2

Integrated Photonics for Secure Quantum Computing and Novel Quantum Communication Tasks

Philip Walther

University of Vienna

Abstract: The advantages of the photons make optical quantum systems ideally suited for quantum foundations experiments and for a variety of quantum information applications. Here I will present new demonstrations of efficient quantum communication tasks as well as experiments that exploit integrated quantum photonics for secure quantum computing schemes and novel quantum communication tasks using the Quantum Zeno effect.

Notes

H3

A Single Chip Solution for Continuous-Variable Quantum Key Distribution (CV QKD)

G. Zhang[1], F. H. Xu[2], J. F. Fitzsimons[3, 4] L. C. Kwek[3], and A. Q. Liu[1†]

[1]School of Electrical and Electronic Engineering, Nanyang Technological University, 50 Nanyang Avenue, Singapore
[2]Shanghai Branch, University of Science and Technology of China, Shanghai 201315, China
[3]Centre for Quantum Technologies, National University of Singapore, 3 Science Drive 2, Singapore
[4]Singapore University of Technology and Design, 20 Dover Drive, Singapore
[†]Email Address: eaqliu@ntu.edu.sg

Abstract: A continuous-variable quantum key distribution (CV-QKD) system is integrated onto a single silicon photonic chip. A proof-of-principle of on-chip CV QKD is demonstrated and the secure key-rate can reach 1.92 Mbit/s at 0 km and 37 kbit/s at 45 km distance.

Quantum key distribution (QKD) is an emerging technology that utilizes some basic theory in quantum mechanics to ensure the absolute communication security. Continuous-variable QKD (CV-QKD) using the weak coherent state as the information carrier. Since on-chip single photon detection and light source technologies are not avariable, the CV-QKD becomes a promising method to achieve next-generation quantum network [1-2]. In this paper, an integrated silicon photonic chip for CV-QKD GG02 coherent-state protocol is demonstrated for the first time. The size of the chip is 0.8 × 6 mm, which contains all the required components. The reduced size is essential for future use in portable devices. A proof-of-principle test is conducted, which shows the secure key rate can reach 1.92 Mbit/s at 0 km distance and 37 kbit/s at 45 km distance per transmission band.

In conclusion, a proof of principle of CV-QKD is integrated onto a single silicon photonic chip is demonstrated. The calculated secure key rate can reach 1.92 Mbit/s at 0 km distance and 37 kbit/s at 45 km distance per transmission band. The well-functioning of such on-chip system will move forward the miniaturization and practical use of CV-QKD.

This work was supported by the Singapore National Research Foundation and Singapore Ministry of Education grands

[1]P. Jouguet, S. Kunz-Jacques, A. Leverrier, P. Grangier, and E. Diamanti. "Experimental demonstration of long-distance continuous-variable quantum key distribution." Nature Photonics 7, 378-381 (2013).
[2]D. Eleni, and A. Leverrier. "Distributing secret keys with quantum continuous variables: principle, security and implementations." Entropy 17, 6072-6092 (2015).

Notes

K1

Putting Nanoplasmonics to Work!

R. Quidant [1, 2, *]

(1) ICFO- Institut de Ciencies Fotoniques, Barcelona
(2) ICREA- Institució Catalana de Recerca i Estudis Avançats, Barcelona

Abstract: Fifteen years of very active research in the field plasmonics have enabled us to considerably advance light control on the nanometer scale. Beyond the original peak of inflated expectation, the assets of nanoplasmonics over other technologies became clearer along with its limitations. More recently, the field has entered into the "slope of enlightenment" in which the actual contribution of metallic nanostructures to future technologies has been better identified. In this talk, following a general introduction on the main assets of plasmonics, we will review different aspects of our research where metallic nanostructures are used as an enabling tool towards novel photonic functionalities.

1. On-a-chip biosensing with optical nanoresonators — Owing to the subwavelength confinement of plasmonic fields, the resonances of optical nano-antennas are extremely sensitive to tiny changes of their surrounding, as for instance induced by the binding of molecules at their surface. This makes them very good candidates for compact, sensitive and low cost biosensing. While last two decades have witnessed a diversity of nano-optical systems with outstanding sensitivity, their implementation into a real analytical device is only at its infancy. In this context, we present here our latest advances in the optical, label-free detection of biomarkers based on gold and silicon nanoantennas integrated into a state-of-the-art microfluidic platform.

2. Nanoscale heat control and its applications – Recent years have witnessed a growing interest in controlling temperature on the nanoscale motivated by applications to different fields, including information technology, chemistry and medicine. Under illumination at its plasmon resonance, a metal nanoparticle features enhanced light absorption, turning it into an ideal nano-source of heat, remotely controllable by light. Such a powerful and flexible photothermal scheme sets the basis of the emerging and fast-growing field of thermo-plasmonics. In this second part of the talk we first briefly present the specificities of heat generation in metal nanoparticles. Then, we present a selection of applications, focusing on reconfigurable metalenses, 3D printing and biomedicine.

Notes

K2

Two Dimensional Metal Chalcogenides and the Device Application

Jun He

National Center for Nanoscience and Technology, Beijing. China
*email: hej@nanoctr.cn

Abstract: While scaling the dimension(s) of semiconductors down to nanoscale, novel properties,such as ultrahigh specific surfaces and strong electrostatic tunability, will show out. Among the various low dimensional structures, two-dimensional (2D) semiconductors may lead the next generation of electronics and optoelectronics due to their compatibility with traditional micro-fabrication techniques and flexible substrates. Up to now, both layered and non-layered materials have been demonstrated to present in 2D geometry. As for the former, even though big breakthroughs, especially on transition metal dichalcogenides (TMDCs), have been made, more systematical and deeper studies are needed. In addition, inspired by the success of 2D layered materials and the fact that many materials with significant functions have non-layered crystal structures, 2D non-layered materials have attracted increasing attentions. Based on above challenges and motivations, our research focuses on the design, synthesis and applications of low dimensional metal chalcogenides semiconductors. In this talk, I will present our recent progress on the following two aspects:
(1) 2D layered metal chalcogenide semiconductors: controllable synthesis, properties, electronic and optoelectronic applications. [1, 3-5, 7, 10]
(2) Van der Waals epitaxial growth, electronic and optoelectronic properties of 2D non-layered materials, such as CdTe, PbS and Pb1-xSnxSe nanosheets. [2, 6, 8, 9]

References

[1] R. Q. Cheng, F. Wang, L. Yin, Z. X. Wang, Y. Wen, T. Shifa and J. He*, Nature Electronics. 1, 356 (2018)
[2] Y. Wen, Q. S Wang, K. M. Cai, R. Q. Cheng, L. Yin, Y. Zhang, J. Li, Z. X. Wang, F. Wang, F. M. Wang, T. A. Shifa, C. Jiang*, H. Lee*, and J. He*, Sci. Adv. 4, eaap7916 (2018)
[3] F. Wang, Z. X. Wang, L. Yin, R. Q. Cheng, J. Wang, Y. Wen, T. Shifa, F. M. Wang, Y. Zhang, X. Y. Zhan, and J. He*, Chem. Soc. Rev. 47, 6296 (2018)
[4] Y. Zhang, L. Yin, J. Chu, T. Shifa, J. Xia, F. Wang, Y. Wen, X. Zhan, Z. Wang*, J. He*, Adv. Mater. 1803665 (2018)
[5] Z. Z. Cheng, T. A. Shifa, F. Wang, Y. Gao, P. He, K. Zhang*, C. Jiang, Q. Liu and J. He*, Adv. Mater. 30, 1707433 (2018)
[6] R. Q. Cheng, Y. Wen, L. Yin, F. M. Wang, F. Wang, K. Liu, T. A. Shifa, J. Li, C. Jiang, Z. X. Wang*, J. He*, Adv. Mater. 29, 1703122 (2017)
[7] K. Xu, D. Chen, F. Yang, Z. X. Wang, L. Yin, F. Wang, R. Q. Cheng, K. Liu, J. Xiong*, Q. Liu*, J. He*, Nano Lett. 17, 1065 (2017)
[8] Y. Wen, L. Yin, P. He, Z. X. Wang, X. Zhang, Q. S. Wang, T. A. Shifa, K. Xu, F. M. Wang, X. Zhan, F. Wang, C. Jiang, and J. He*, Nano Lett. 16, 6437 (2016)
[9] Y. Wen, Q. S. Wang, L. Yin, Q. Liu, F. Wang, F. M. Wang, Z. X. Wang, K. Liu, K. Xu, Y. Huang, T. A. Shifa, C. Jiang*, J. Xiong* and J He*, Adv. Mater. 28, 8051 (2016)
[10] F. Wang, Z. X. Wang, K. Xu, F. M. Wang, Q. S. Wang, Y. Huang, L. Yin and J. He*, Nano Lett. 15, 7558 (2015)

Notes

K3

Dynamic plasmonics

Laura Na Liu

Kirchhoff Institute for Physics, University of Heidelberg, Im Neuenheimer Feld 227, 69120 Heidelberg, Germany

Abstract: A prerequisite to build advanced plasmonic architectures is the ability to precisely control the organization of metal nanoparticles in space. To this end, DNA origami represents an ideal construction platform owing to its unique sequence specificity and structural versatility. I will present sequentially a diverse set of DNA-assembled plasmonic nanostructures according to their characteristic optical properties. I will also discuss about the inevitable evolution from static to dynamic plasmonic systems along with the fast development of this inter-disciplinary field. Finally, possible future directions and perspectives on the challenges are elucidated.

Biography: Laura Na Liu is a professor at the Kirchhoff Institute for Physics at University of Heidelberg, Germany. She received her Ph. D in Physics at University of Stuttgart in 2009, working on 3D complex plasmonics at optical frequencies. In 2010, she worked as postdoctoral fellow at the University of California, Berkeley. In 2011, she joined Rice University as Texas Instruments visiting professor. At the end of 2012, she obtained a Sofja Kovalevskaja Award from the Alexander von Humboldt Foundation and became an independent group leader at the Max-Planck Institute for Intelligent Systems. She joined University of Heidelberg in 2015. Her research interest is multi-disciplinary. She works at the interface between nanoplasmonics, biology, and chemistry. Her group focuses on developing sophisticated and smart plasmonic nanosystems for answering structural biology questions as well as catalytic chemistry questions in local environments.

Notes

K4

Mid-IR Metasurfaces for Molecular Specific Biosensors

Hatice Altug

[1]Institute of Bioengineering, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland
hatice.altug@epfl.ch

Abstract: Mid-IR spectroscopy is the technique of choice for chemical identification of biomolecules through its label-free and non-destructive way of accessing molecular structure. Nevertheless, state-of-the-art IR spectroscopy techniques face fundamental challanges. For instance, absorption signals of biomolecules are extremely weak due to the size mismatch between mid-IR wavelengths and nanometric samples. Strong water absoprtion severely limits measurements in aqueous environment, which is detrimental for biological studies. Furthermore, current IR equipments are bulky and expensive preventing their use in a wide range of applications. Nanophotonics offer exciting prospects to address these challenges through surface enhanced Infrared absorption spectroscopy (SEIRA).

In this talk I will share our recent breakthroughs using plasmonics nanoantennas and all-dielectric metasurfaces. In particular, I will present a new large-area imaging-based nanophotonic method capable of detecting mid-infrared molecular fingerprints without the need for spectrometry, frequency scanning, or moving mechanical parts. Our method leverages 2D array of high-Q dielectric metasurfaces to convert absorption signatures of surface adsorbed molecules into a barcode-like spatial absorption map, providing unique prospects for chemical analysis by using advanced data science techniques. I will also show how Mid-IR metasurface-based sensors are suitable to study biological process involving multiple molecular components due to their inherent chemical specificity.

Notes

L1

High Contrast Metastructures for Flat Photonics Applications

Connie J. Chang-Hasnain

Dept. of Electrical Engineering and Computer Science
University of California, Berkeley, CA 94720
email: cch@berkeley.edu

Abstract: A new class of planar optics has emerged using near-wavelength dielectric structures, known as high contrast metastructures (HCM). Many extraordinary properties can be designed top-down based for integrated optics on a silicon or GaAs substrate. Using a 1D HCM as a high reflectivity mirror, we demonstrated a wavelength-swept vertical cavity surface emitting lasers (VCSELs) with a record wavelength range and 600 kHz swept rate. Such devices have applications for data communications, LIDAR and optical coherent tomography applications. A single layer HCM can also be designed as high quality-factor surface-normal resonators. I will review recent results using and its applications as biosensor, 4-wave generation, and spatial light modulator. Finally, we also demonstrated a novel design that mimics the color tuning effect of chameleon skin with color change achieved simultaneously in a multiple-color pattern flat structure.

Notes

L2

Metasurfaces: Efficiency, Couplings, and Angular Dispersions

Lei Zhou

[1] *Physics Department, Fudan University, Shanghai 200433, China,*
**E-mail: phzhou@fudan.edu.cn*

Abstract: Metasurfaces are ultra-thin metamaterials composed by artificial planar meta-atoms arranged in some specific macroscopic orders, which exhibit extraordinary capabilities to control electromagnetic (EM) waves. In this talk, we briefly summarize our latest efforts on exploring the new physics appearing in metasurfacs and employing metasurfaces to control electromagnetic waves. We first discuss how to realize high-efficiency transmissive PB metasurfaces in GHz and THz frequencies, based on which both light bending and Bessel beam generations can be realized. We next explore the role of couplings in dictating the physical responses of complex meta-atoms, which can guide us design functional meta-atoms with tailored properties. Finally, we investigate the physics underlying the angular dispersions in metasurfaces and show how to utilize the angular dispersions to design multifunctional metasurfaces.

References

[1] Weijie Luo, et al., Adv. Opt. Mater. 3, 1102 (2015); Phys. Rev. Appl. 7, 044033 (2017)
[2] Zhuo Wang, et al., Appl. Phys. Lett. 112, 191901 (2018)
[3] Min Jia, et al., under review.
[4] Qiong He, et. al., Adv. Opt. Mater. DOI: 10.1002/adom.201800415 (Invited review)
[5] Meng Qiu, Min Jia, et al., Phys. Rev. Applied 9, 054050 (2018)
[6] Xiyue Zhang, Qi Li, et al., manuscript in preparation.

Notes

L3

From Fiber Optic Networks to Neuron Networks: Foundry Integrated 3D Silicon Photonics

Joyce Poon
University of Toronto

Abstract: Foundry-manufactured, monolithically integrated multilayer silicon nitride-on-silicon (SiN-on-Si) photonic platforms are suitable for large-scale photonic circuits. These photonic platforms contain several waveguide layers, and light is routed amongst the layers to realize 3D photonic devices and circuits. We have realized a suite of passive and active devices in these platforms, including ultra-low-loss waveguide crossings, multi-layer grating couplers, and efficient Si modulators. These advancements, which were initially driven by telecom applications, are leading to neurophotonic implants for brain activity mapping.

Notes

Yun-Jiang Rao*

L4

Integrated Optical Fiber Sensors

Yun-Jiang Rao*

Fiber Optics Research Center
Key Lab of Optical Fiber Sensing & Communications (Education Ministry of China),
University of Electronic Science & Technology of China, Chengdu, Sichuan 610054, China
**yjrao@uestc.edu.cn*

Abstract: Optical fiber has been applied to communications as a revolutionary transmission medium over the last 50 years. For the last 30 years, optical fibers have been used to generate high power lasing and achieve high performance sensing. Optical fibers, made of SiO_2, can sense rotation, temperature, strain, pressure, acoustic wave, acceleration, displacement, electrical/magnetic field, refractive index, flow rate, biochemical components, et al. as an optical nerve [1-3]. Optical fiber sensors (OFS) are being broadly advanced as they have numerous advantages over conventional sensors such as the ability to function in harsh environments, capability to operate in long-distance remote measurements, immunity to electromagnetic interference, et al. Also, OFS can be used as embedded sensors in composite materials to achieve "smart structures". OFS have shown considerable potential for sensing in various fields, such as energy, aerospace, security, civil engineering, biomedicine, et al. OFS has become one of the mainstreams in modern sensing technologies.

Among the OFS family, integrated optical fiber sensors (IOFS) have been demonstrated for achieving ultimate sensing due to their outstanding advantages, including multi-functionality, small-sizes, high-sensitivity, fast-response, easy-multiplexing, et al. By integrating micro-structures such as gratings and interferometers into optical fibers and combining new materials and microfluidics with optical fibers, a number of novel IOFS are proposed and demonstrated by the Fiber Optics Research Center (FORC) at University of Electronic Science & Technology of China (UESTC). This presentation presents a review on these advances, including:

(1) IOFS combining fiber Bragg grating (FBG) [4] or long-period fiber grating (LPFG) with all-fiber micro Fabry-Perot interferometers [5] to achieve simultaneous measurement of high temperature and strain, leading to important applications in aerospace industry.

(2) IOFS combining nanomaterials like graphene to achieve ultrahigh sensitivity chemical sensing, leading to new sensitivity record, such as ~ppb for fiber-optic gas detection [6].

(3) IOFS combining microfluidics with hollow optical fibers to develop all-fiber optofluidic laser sensors with sub-molecule-layer sensitivity, leading to realization of highly sensitive chip-scale fiber-arrayed biochemical sensors that are disposable [7].

References

[1] S. Yin, P. B. Ruffin, and F. T. S. Yu, Fiber Optic Sensors, CRC press, USA, 2008.

[2] G. Rajan, Optical Fiber Sensors: Advanced Techniques and Applications, CRC press, USA, 2015.

[3] H. Hartog, An Introduction to Distributed Optical Fibre Sensors, CRC press, USA, 2018.

[4] Y. J. Rao, "Review Article: In-fiber Bragg Grating Sensors," Measurement Sci. & Technol., 8, 355-375, 1997.

[5] Y. J. Rao, Z. L. Ran, and Y. Gong, Fiber-Optic Fabry-Perot Sensors: An Introduction, CRC press, USA, 2018.

[6] B. C. Yao, C. B. Yu, Y. Wu, S. W. Huang, H. Wu, Y. Gong, Y. F. Chen, Y. R. Li, C. W. Wong, X. D. Fan, and Y. J. Rao, "Graphene-en-

hanced Brillouin optomechanical microresonator for ultrasensitive gas detection," Nano Letters, 17, 4996-5002, 2017.
[7] C. Gong, Y. Gong, X. Zhao, Y. Luo, Q. Chen, X. Tan, Y. Wu, X. Fan, G. Peng, and Y. J. Rao, "Distributed fiber optofluidic laser for chip-scale arrayed biochemical sensing," Lab on a Chip, 18, 2741-2748, 2018.

Notes

L5

Microwave and RF Applications of Kerr Micro-combs

David Moss
Swinburne University of Technology

Notes

Plenary Talk 5

Nanophotonic Concepts for Thermal and Energy Applications

Shanhui Fan

Stanford University

Abstract: Photons represent one of the most important carriers of energy. New concepts to control photons, as being advanced by a wide variety of nanophotonic and meta-material structures and techniques, can therefore have profound implications for energy technology. In this talk, we will discuss some of the examples related to nanophotonic concepts in energy, including radiative cooling and dynamic wireless power transfer.

Notes

公司简介 COMPANY PROFILE

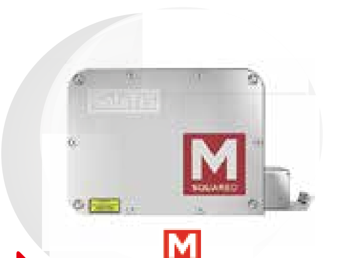
PulsePower 脉动科技

脉动科技隶属于北京铸久国际贸易有限公司。脉动科技有限公司是专业的激光器代理公司，致力于国外先进激光器，光电子产品的代理、销售、技术服务和进口业务，服务于国内外高端科研和先进工业市场。现已成为国内最大的激光器代理商之一。脉动科技目前代理的产品囊括激光器的大多数品种和主流的品牌，包括众多世界著名的公司。

脉动科技有限公司的服务团队由来自天津大学，中科大，北理工，长春理工等著名大学激光专业的高端人才组成，其中硕士以上学历占70%以上，核心成员有超过12年的激光器销售、技术服务经验。脉动科技有限公司注册于香港，总部设于北京，上海、西安、深圳和成都设有办事处。作为迅速发展中的公司，欢迎有志之士共同合作、支持！

代理品牌 AGENT PRODUCTS

百赫兹大能量纳秒激光器
INNOLAS EVO



单频连续钛宝石激光器
SolsTis


单频光纤激光器种子

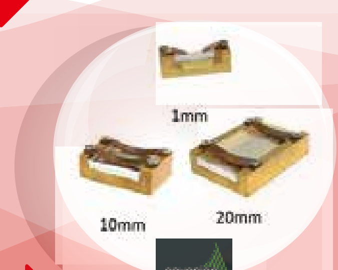
光束整形器

飞秒光参量放大器
venteon OPCPA

德国APE超快测量设备

美国PI皮秒激光器

法国amplitude systemes
光纤飞秒激光器



英国Covesion公司
PPLN晶体

脉动科技有限公司
全国销售和售后电话

北京总部
地址：北京市海淀区中关村333号楼 100190
电话：010-62565117
传真：010-62565117-811

上海办事处
地址：上海市长宁区茅台路868号光华大厦南楼1009室，200336
电话：021-60720971
60720972
传真：021-60720971

西南办事处
地址：(西安)西安市碑林区南二环西段太白路立交西北未来城 3# 楼2404 室710068
(成都)成都市锦江区锦江东路555号尖东旺座1314

深圳办事处
地址：深圳市南山区桃园路1号西海明珠大厦E栋1207室
邮编：518052
电话：0755-26922729
传真：0755-23306506

单光子计数——产品推荐

公司介绍

etsc 东隆科技
ETSC Technologies Co., Ltd

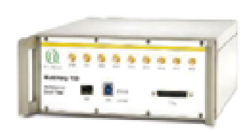
武汉东隆科技有限公司，与国内外多家量子科学领域的顶尖企业和研究单位合作，为您提供量子光学研究领域的全套产品。包括多通道高精度计数器，超导纳米线探测器（量子效率高于85%1550nm），纠缠光子源，可见光/红外单光子探测器等一系列产品。同时，东隆拥有强大的技术团队，从系统搭建，软件开发到售后服务，将为您提供专业的技术支持和热情的服务。

多通道皮秒高精度计数器/事件计时器/符合计数器

PicoQuan提供多种类型的高端、易用、即插即用台式型或高速板卡型的时间相关单光子计数器/事件计时器/符合计数器。它最多可扩展至8个独立探测通道，也可以多台级联工作，主机采用USB3.0/USB2.0/PCIe等高速接口与计算机通讯。

指标	HydraHarp 400	PicoHarp 300	TimeHarp 260 PICO	MultiHarp 150
探测通道数	2、4、6或8	2	1+1 或 1+2	4 或 8
最小时间分辨宽度	1 ps	4 ps	25 ps	80 ps
死时间	＜ 80 ns	＜ 95 ns	＜ 25 ns	< 650 ps
接口	USB 3.0	USB 2.0	PCIe 1.1x1	USB3.0



超导纳米线探测器Quantum Opus

Opus One

它基于超导纳米线技术的单光子探测器，在1550 nm的探测效率高达85 %，通过对谐振腔的调节，可以提供特殊设计、订购和组装。

- 工作温度在2.5k可达到最高探测效率
- 支持各需求定制
- 3U紧凑化设计
- 时间抖动<80ps/100ps
- 暗计数<1Hz/10Hz/100Hz
- 死时间<50ns

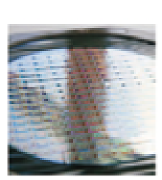
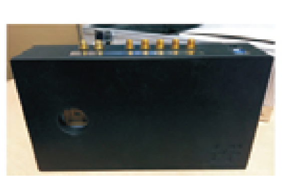
可见光单光子探测器PDM/COUNT

我们提供2种类型的可见光单光子探测器：

- 时间分辨率35ps（典型值）
- 探测效率49%@550nm
- 暗计数：5~100cps
- 空间光或FC光纤接口

- 时间分辨率350ps（典型值）
- 探测效率65%@650nm (提供NIR>60%款)
- 暗计数：50~500cps
- FC光纤接口/空间光

32*32SPAD+TDC单光子计数相机（SPAD+TDC camera）：PF32

- 阵列尺寸：32 × 32 个像素、1.6 × 1.6mm
- SPAD 灵敏区：6.95μm ⌀
- 像素间距：50μm
- 探测效率最高可达28%@ 500nm
- 时间抖动：<200ps FWHM
- Time bin最小可达55ps
- USB3.0高速接口

NJU NIP
NOV 9-11, 2018
Nanjing, China

a nature conference
on Nanophotonics and Integrated Photonics 2018