HYFUgroup photonics lab

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Lirong

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# Contents

1 Research 3
2 People 5
3 Publications 7
4 News 15
5 Resources 17
Welcome to HYFUgroup Photonics Lab. We are a group of photonics researchers at Nano-Devices Laboratory, Tsinghua-Berkeley Shenzhen Institute, Tsinghua University. Our research interests include optical wireless communication, silicon photonics and advanced sensing technologies.

Our vision: Enabling people’s future life with advanced optical technologies.
1.1 Optical Wireless Communication

Optical Wireless Communication (OWC) is a short-range wireless access technology and an important supplement to other existing wireless communication systems. Due to the high frequency of light waves, OWC has large information carrying capacity. Light waves also have rich broadband spectrum resources and strong anti-electromagnetic interference capabilities compared with radio frequency. In addition, OWC based on semiconductor light source are highly power efficient. With the technological breakthroughs of optoelectronic materials and devices, the cost of OWC will be further reduced, OWC technology will have a competitive advantage and transformative value that cannot be underestimated in the future information society where everything is connected.

1.2 Silicon Photonics

Silicon photonics is a promising solution to provide low-cost and high-performance integrated chip-based photonic devices and systems. Currently, it is commercially driven by the increasing demand for low-cost short-range optical interconnects in data centers and the computing industry. In the future, it might also be attractive for applications in biosensing and light detection and ranging (LiDAR). Our group focus on design of key passive integrated components including fiber-to-chip interface, waveguide crossings and multiplexing components (polarization, mode and wavelength division multiplexing). Apart from traditional design method based on intuition and physics, we also explore computer-automated design using advanced algorithms and deep neural networks.

1.3 Advanced Sensing Technologies

3D-Sensing (LiDAR, OCT): FMCW LiDAR (Frequency Modulated Continuous Wave, Light Detection and Ranging) allows us to measure distance with millimeter or micrometer range resolution, which can be applied in high accuracy 3D sensing and mapping. Swept-source optical coherence tomography (SS-OCT) with high precision in 3D reconstructions of biological tissues also relies on this technique. In addition, we also try to combine with other research field such as femtosecond mode-locked laser to set up fancy LiDAR system.
Microcavity Sensing: Whispering gallery mode (WGM) resonators, with superior performance compared with other resonators, have emerged in recent years as versatile and ultra-sensitive technology for sensing applications, which is the basis for the development of physical, chemical and biological sensors. In our research group, we use micro-cavity (e.g. Microbubble) to realize different sensing applications, such as ultra-low detection limit sensors.

Optical nonlinearity:

1) **Ultrafast mode-locked fiber** lasers exhibit superior thermo-optical properties and excellent beam quality, making them suitable for a wide range of applications. We have constructed several nonlinear amplifying loop mirror (NALM)-based fiber lasers, which can generate pulses with good optical performance or interesting nonlinear phenomena.

2) Much efforts have made to the generation of broadband light due to its promising applications such as high-precision frequency metrology, optical coherence tomography and optical communications. We have demonstrated **supercontinuum generation** in a highly nonlinear dispersion shifted fiber.
2.1 Professor

2.1.1 EDUCATION

Ph.D. Electrical Engineering, The Hong Kong Polytechnic University
M.Sc. Electrical Engineering, Royal Institute of Technology (KTH), Sweden
B.Eng. Information and Electronic Engineering, Zhejiang University

2.1.2 RESEARCH INTERESTS

Integrated Photonics and Their Applications for Communications and Sensing, including Optical Wireless Communications, Silicon Photonics, Optical Nonlinearity, Microcavity Sensing, 3D-Sensing (LiDAR, OCT).

2.1.3 PROFESSIONAL EXPERIENCES

2017-present, Associate Professor, Nano-Devices Laboratory, Tsinghua-Berkeley Shenzhen Institute, Tsinghua University
2016-2017, Project Officer, Central Research Institute, Huawei Technologies
2012-2016, Project Manager, Central Research Institute, Huawei Technologies
2010-2012, Senior Research Engineer, Central Research Institute, Huawei Technologies
2009-2010, Research Associate, Photonic Research Centre, The Hong Kong Polytechnic University
2008-2009, Research Assistant, Photonic Research Centre, The Hong Kong Polytechnic University

2.1.4 HONORS AND AWARDS

Best Poster Award, ACP 2019, Student: Alberto Pepe
Best Student Paper Award, IEEE ICOCN 2019, Student: Xin Mu
The President Commendation (Best Innovation Team), CRI, Huawei, 2015
The President Commendation (Outstanding Research Contribution Award), CRI, Huawei, 2014
The President Commendation (Best Innovation Team), CRI, Huawei, 2014
Overseas High-Caliber Personnel, Shenzhen, 2013

2.1.5 AFFILIATIONS AND ACTIVITIES

Life Member of The Optical Society (OSA)
Life Member of Society of Photo-Optical Instrumentation Engineers (SPIE)
Member of Institute of Electrical and Electronics Engineers (IEEE)
Committee Member of IEEE Photonics Society (IPS) Guangdong Chapter
Council Member of Shenzhen Society of Micro-Nano Technology
Founding Advisor of the OSA, SPIE, IPS Student Chapters at Tsinghua U. Shenzhen

2.2 Students

2.2.1 Current Students

2.2.2 Graduated Students
Visit our latest publications on Google Scholar

3.1 Book Chapters


3.2 Invited Talks


3.3 Selected Journal Papers


3.4 Selected Recent Conference Papers

[34] Zhenmin Chen, Qian Li, and H. Y. Fu*, “Tuning stimulated Brillouin scattering by two lasers pumping in a WGM microcavity,” in Proc. of The Conference on Lasers and Electro-Optics (CLEO’2020), San Jose, California, USA, May 12th-14th, 2020.


Chapter 3. Publications

Communications and Photonics Conference (ACP’2019), M4D.2, Chengdu, China, Nov. 2019. (One of the eight Post Deadline Paper for ACP2019)


[55] Xin Mu, Sailong Wu, Lirong Cheng, Xin Tu and H. Y. Fu*, “A Compact Adiabatic Silicon Photonic Edge Coupler Based on Silicon Nitride/Silicon Trident Structure”, in Proc. Of the 18th International Conference on Optical Communications & Networks (ICOCN), W2G.4, Huangshan, China, Aug. 5th -8th, 2019. (Best Student Paper Award for IEEE ICOCN2019)

[56] Sailong Wu, Xin Mu, Lirong Cheng, Xin Tu and H. Y. Fu*, “Polarization-insensitive Waveguide Crossings Based on SWGs-assisted MMI”, in Proc. Of the 18th International Conference on Optical Communications & Networks (ICOCN), W2G.1, Huangshan, China, Aug. 5th -8th, 2019. (Shortlisted for Best Student Paper Award Competition)

[58] Renlai Zhou, Xuanyi Liu, Guanyu Liu, H. Y. Fu, Qian Li* and Zhigang Zhang, “Robust All Polarization-maintaining Femtosecond Fiber Laser with Various Phase Bias”, in Proc. Of the 18th International Conference on Optical Communications & Networks (ICOCN), T3B.4, Huangshan, China, Aug. 5th -8th, 2019. (Shortlisted for Young Scientist Award Competition)


[64] Yi Qian, Hamid Mehrvar, Dawei Wang, H. Y. Fu*, Dongyu Geng, Dominic Goodwill, Eric Bernier “Scalable Photonic Switch with Crosstalk Suppression for Datacenters and Optical Networks,” in Proc. of the 20th Optoelectronics and Communications Conference (OECC), Shanghai, China, Jul. 2015.


### 3.5 Selected Patents


[P12] Spot size Converter and Apparatus for Optical Conduction, EP14897866.1
[P13] Polarizer and Polarization Modulation System, EP13899938.8
[P18] CN104166291B
[P19] , : 201910333223.2
[P20] , :201910295793.7
[P21] , : 201910285586.3
[P22] , : 201910074468.8
[P23] VCSEL, : 201811039293.9
[P24] , :201811564347.3
[P25] VCSEL, :201811039293.9
[P26] , :201810751591.4
[P27] , :201810802301.4
[P28] , :201811002828.5
[P29] , :201810636495.5
[P30] , : CN107076932A
[P31] , : CN106461865A
[P32] , : CN106575999A
[P33] , : CN104469555A
[P34] , : CN105829933A
[P35] , : CN105829935A
[P36] , : CN105829956A
[P37] , : CN105849608A
[P38] , : CN105874314A
[P39] , : CN105981240A
[P40] , : CN106461866A

3.5. Selected Patents
CHAPTER 4

News

2020/6/29 Website online.
CHAPTER 5

Resources

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Scan to subscribe our OSA student chapter Wechat account:
Congratulations to our 2020 master graduates!!