# Columbia Nano Initiative, Columbia University 530 West 120th St, New York, NY 10027

# Yuyang Wang

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# Research -

I design large-scale integrated photonic systems to transform future computing paradigms. Addressing communication bottlenecks in AI/machine learning applications through embedded photonic I/O and heterogeneous integration, I aim to redefine chip-to-chip connectivity with unparalleled density and novel functionalities beyond data communication.

# APPOINTMENT -

# Columbia University in the City of New York

New York, NY, USA

2021-Present

Postdoctoral Research Scientist, Columbia Nano Initiative

- Mentored by Prof. Keren Bergman
- Photonics design and integration, DARPA PIPES program, led the Phase 2 development and the successful transition to Phase 3

# EDUCATION -

# University of California, Santa Barbara

Santa Barbara, CA, USA

2018-2021

Ph.D. in Electrical and Computer Engineering

Co-advised by Prof. Kwang-Ting Cheng and Prof. John E. Bowers

#### Santa Barbara, CA, USA

University of California, Santa Barbara M.S. in Electrical and Computer Engineering

2015-2018

**Tsinghua University** B.Eng. in Electronic Engineering Beijing, China

2011-2015

# Experience -

#### Semiconductor Research Corporation (SRC) Research Scholars Program

Research Scholar, Center for Ubiquitous Connectivity (CUbiC) under SRC JUMP 2.0

2023-Present

- Contributed to the writing and visualization of the proposal that led to the award of \$35M JUMP 2.0 grant for the CUbiC Center
- Co-led the CUbiC Scholar Leadership Council and the Systems and Testbeds subgroup; organized monthly workshops with industry liaisons

#### Hong Kong University of Science and Technology

Hong Kong SAR, China

Postgraduate Visiting Intern, Department of Electrical and Computer Engineering

Aug. 2019-Dec. 2019

#### Cadence Design Systems, Inc.

San Jose, CA, USA Design Engineering Intern - Photonics, Custom IC & PCB Group

Jun. 2018-Sep. 2018

**Rice University** 

Houston, TX, USA

Student Intern, Department of Electrical and Computer Engineering

Jul. 2014-Sep. 2014

# Publication -

#### **Journal Articles**

- J1 Y. Wang, S. Wang, R. Parsons, S. Sanyal, V. Gopal, A. Novick, A. Rizzo, M. Lipson, A. L. Gaeta, and K. Bergman, "Co-designed silicon photonics chip I/O for energy-efficient petascale connectivity," IEEE Transactions on Components, Packaging and Manufacturing Technology, 2024, in press. doi 10.1109/TCPMT.2024.3492189 invited
- J2 Z. Wu, L. Yuan Dai, Y. Wang, S. Wang, and K. Bergman, "Flexible silicon photonic architecture for accelerating distributed deep learning," Journal of Optical Communications and Networking, vol. 16, no. 2, A157, Feb. 1, 2024. (a) 10.1364/JOCN.497372 invited

- J3 A. James, A. Rizzo, Y. Wang, A. Novick, S. Wang, R. Parsons, K. Jang, M. Hattink, and K. Bergman, "Process Variation-Aware Compact Model of Strip Waveguides for Photonic Circuit Simulation," *Journal of Lightwave Technology*, pp. 1–14, 2023. 20 10.1109/JLT.2023.3238847
- J4 A. Novick, A. James, L. Y. Dai, Z. Wu, A. Rizzo, S. Wang, Y. Wang, M. Hattink, V. Gopal, K. Jang, R. Parsons, and K. Bergman, "High-bandwidth density silicon photonic resonators for energy-efficient optical interconnects," *Applied Physics Reviews*, vol. 10, no. 4, p. 041 306, Nov. 2023.
- Y. Wang, P. Sun, J. Hulme, M. A. Seyedi, M. Fiorentino, R. G. Beausoleil, and K.-T. Cheng, "Energy Efficiency and Yield Optimization for Optical Interconnects via Transceiver Grouping," Journal of Lightwave Technology, vol. 39, no. 6, pp. 1567–1578, Mar. 2021. (20) 10.1109/JLT.2020.3039489
- J6 Z. Zhang, R. Wu, Y. Wang, C. Zhang, E. J. Stanton, C. L. Schow, K.-T. Cheng, and J. E. Bowers, "Compact Modeling for Silicon Photonic Heterogeneously Integrated Circuits," *Journal of Lightwave Technology*, vol. 35, no. 14, pp. 2973–2980, Jul. 2017. (20) 10.1109/JLT.2017.2706721

#### Conference Proceedings

- C1 A. Novick, M. Hattink, A. Rizzo, **Y. Wang**, V. Gopal, S. Wang, R. Parsons, and K. Bergman, "Integrated Photonic Resonant Modulator-Based Equalization and Optimization for DWDM," in *Optical Fiber Communication Conference (OFC) 2024*, San Diego California: Optica Publishing Group, 2024, W1K.5. 10.1364/OFC.2024.W1K.5
- C2 S. Wang, Y. Wang, X. Meng, K. Hosseini, T. T. Hoang, and K. Bergman, "Automated Tuning of Ring-Assisted MZI–Based Interleaver for DWDM Systems," in *Optical Fiber Communication Conference (OFC) 2024*, San Diego California: Optica Publishing Group, 2024, Th1A.3.

  © 10.1364/OFC.2024.Th1A.3
- C3 Y. Wang, S. Wang, R. Parsons, A. Novick, V. Gopal, K. Jang, A. Rizzo, C.-P. Chiu, K. Hosseini, T. T. Hoang, S. Shumarayev, and K. Bergman, "Silicon Photonics Chip I/O for Ultra High-Bandwidth and Energy-Efficient Die-to-Die Connectivity," in 2024 IEEE Custom Integrated Circuits Conference (CICC), Denver, CO, USA: IEEE, Apr. 21, 2024, pp. 1–8. (2) 10.1109/CICC60959.2024.10529018 invited
- C4 Z. Wu, R. Parsons, S. Wang, Y. Wang, and K. Bergman, "Wavelength Reconfigurable Transceiver For Multi-Interface Compute Accelerator Networks," in *Optical Fiber Communication Conference (OFC) 2024*, San Diego California: Optica Publishing Group, 2024, W4F.2. 10.1364/OFC.2024.W4F.2
- C5 G. Michelogiannakis, Y. Arafa, B. Cook, L. Y. Dai, A.-H. Hameed Badawy, M. Glick, Y. Wang, K. Bergman, and J. Shalf, "Efficient Intra-Rack Resource Disaggregation for HPC Using Co-Packaged DWDM Photonics," in 2023 IEEE International Conference on Cluster Computing (CLUSTER), Santa Fe, NM, USA: IEEE, Oct. 2023, pp. 158–172. (2) 10.1109/CLUSTER52292.2023.00021
- C6 S. Wang, A. Novick, A. Rizzo, R. Parsons, S. Sanyal, K. J. McNulty, B. Y. Kim, Y. Okawachi, Y. Wang, A. Gaeta, M. Lipson, and K. Bergman, "Integrated, Compact, and Tunable Band-Interleaving of a Kerr Comb Source," in *CLEO 2023*, San Jose, CA: Optica Publishing Group, 2023, STh3J.6. (20) 10.1364/CLEO\_SI.2023.STh3J.6
- C7 Y. Wang, A. Novick, R. Parsons, S. Wang, K. Jang, A. James, M. Hattink, V. Gopal, A. Rizzo, C.-P. Chiu, K. Hosseini, T. T. Hoang, and K. Bergman, "Scalable architecture for sub-pJ/b multi-Tbps comb-driven DWDM silicon photonic transceiver," in *Next-Generation Optical Communication:*Components, Sub-Systems, and Systems XII, G. Li, K. Nakajima, and A. K. Srivastava, Eds., San Francisco, United States: SPIE, Mar. 2023, p. 55.

  10.1117/12.2649506 invited
- C8 Y. Wang, S. Wang, A. Novick, A. James, R. Parsons, A. Rizzo, and K. Bergman, "Dispersion-Engineered and Fabrication-Robust SOI Waveguides for Ultra-Broadband DWDM," in *Optical Fiber Communication Conference (OFC) 2023*, San Diego California: Optica Publishing Group, 2023, Th3A.4. (a) 10.1364/OFC.2023.Th3A.4
- C9 A. James, **Y. Wang**, A. Rizzo, and K. Bergman, "Flexible, Process-Aware Compact Model of Effective Index in Silicon Waveguides for Commercial Foundries," in 2022 International Conference on Numerical Simulation of Optoelectronic Devices (NUSOD), Turin, Italy: IEEE, Sep. 2022, pp. 173–174.
- C10 Y. Wang and K.-T. Cheng, "Traffic-Adaptive Power Reconfiguration for Energy-Efficient and Energy-Proportional Optical Interconnects," in 2021 IEEE/ACM International Conference On Computer Aided Design (ICCAD), Munich, Germany: IEEE, Nov. 2021, pp. 1–9. 10.1109/ICCAD51958.2021.9643475
- C11 Y. Wang, J. Hulme, P. Sun, M. Jain, M. A. Seyedi, M. Fiorentino, R. G. Beausoleil, and K.-T. Cheng, "Characterization and Applications of Spatial Variation Models for Silicon Microring-Based Optical Transceivers," in 2020 57th ACM/IEEE Design Automation Conference (DAC), San Francisco, CA, USA: IEEE, Jul. 2020, pp. 1–6. 10.1109/DAC18072.2020.9218608
- C12 Y. Wang and K.-T. Cheng, "Task Mapping-Assisted Laser Power Scaling for Optical Network-on-Chips," in 2019 IEEE/ACM International Conference on Computer-Aided Design (ICCAD), Westminster, CO, USA: IEEE, Nov. 2019, pp. 1–6. 10.1109/ICCAD45719.2019.8942146
- C13 Y. Wang, M. A. Seyedi, J. Hulme, M. Fiorentino, R. G. Beausoleil, and K.-T. Cheng, "Bidirectional tuning of microring-based silicon photonic transceivers for optimal energy efficiency," in *Proceedings of the 24th Asia and South Pacific Design Automation Conference*, Tokyo Japan: ACM, Jan. 2019, pp. 370–375. 10.1145/3287624.3287649
- Y. Wang, L. Shao, M. A. Lastras-Montano, and K.-T. Cheng, "Taming Emerging Devices' Variation and Reliability Challenges with Architectural and System Solutions [Invited]," in 2019 IEEE 32nd International Conference on Microelectronic Test Structures (ICMTS), Kita-Kyushu City, Fukuoka, Japan: IEEE, Mar. 2019, pp. 90–95. 10.1109/ICMTS.2019.8730924 invited
- Y. Wang, M. A. Seyedi, R. Wu, J. Hulme, M. Fiorentino, R. G. Beausoleil, and K.-T. Cheng, "Energy-efficient channel alignment of DWDM silicon photonic transceivers," in 2018 Design, Automation & Test in Europe Conference & Exhibition (DATE), Dresden, Germany: IEEE, Mar. 2018, pp. 601–604. 10.23919/DATE.2018.8342079

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- C16 R. Wu, M. A. Seyedi, Y. Wang, J. Hulme, M. Fiorentino, R. G. Beausoleil, and K.-T. Cheng, "Pairing of microring-based silicon photonic transceivers for tuning power optimization," in 2018 23rd Asia and South Pacific Design Automation Conference (ASP-DAC), Jeju: IEEE, Jan. 2018, pp. 135–140. (a) 10.1109/ASPDAC.2018.8297295
- C17 R. Wu, Y. Wang, Z. Zhang, C. Zhang, C. L. Schow, J. E. Bowers, and K.-T. Cheng, "Compact modeling and circuit-level simulation of silicon nanophotonic interconnects," in *Design, Automation & Test in Europe Conference & Exhibition (DATE), 2017,* Lausanne, Switzerland: IEEE, Mar. 2017, pp. 602–605. (a) 10.23919/DATE.2017.7927057
- C18 A. Ghofrani, M. A. Lastras-Montaño, **Y. Wang**, and K.-T. Cheng, "In-place Repair for Resistive Memories Utilizing Complementary Resistive Switches," in *Proceedings of the 2016 International Symposium on Low Power Electronics and Design*, San Francisco Airport CA USA: ACM, Aug. 2016, pp. 350–355. 10.1145/2934583.2934590
- C. Xu, F. X. Lin, **Y. Wang**, and L. Zhong, "Automated OS-level Device Runtime Power Management," in *Proceedings of the Twentieth International Conference on Architectural Support for Programming Languages and Operating Systems*, Istanbul Turkey: ACM, Mar. 2015, pp. 239–252. (a) 10.1145/2694344.2694360

#### **Under Review and In Preparation**

- P1 V. Gopal, A. Novick, M. Hattink, S. Sanyal, S. Wang, M. Cullen, A. Rizzo, A. E. James, Y. Wang, X. Meng, M. Lipson, A. L. Gaeta, and K. Bergman, "Resonant modulator-based equalization for frequency comb-driven dense wavelength division multiplexing interconnects," *Journal of Lightwave Technology*, under review.
- P2 N. Nauman, J. Robinson, Y. Wang, K. Jang, X. Meng, and K. Bergman, "Photonic analog-to-digital architecture for accelerating multiply-accumulate operations," in *Optical Fiber Communication Conference (OFC) 2025*, under review.
- P3 R. Parsons, S. Sanyal, M. Cullen, Y. Wang, A. Novick, X. Ji, Y. Okawachi, X. Meng, M. Lipson, A. Gaeta, and K. Bergman, "Dispersion-engineered resonator-based interleaver co-designed with Kerr comb source," in *Optical Fiber Communication Conference (OFC) 2025*, under review.
- P4 A. Rovinski, Y. Ou, C. Ou, D. Khilwani, **Y. Wang**, S. Wang, S. Lee, K. Bergman, A. Molnar, and C. Batten, "Scaling co-packaged optical interconnects using hybrid 2.5D/3D integration," in 2025 *IEEE International Symposium on Circuits and Systems (ISCAS)*, under review.
- P5 S. Wang, R. Parsons, A. Novick, V. Gopal, M. Cullen, A. Rizzo, **Y. Wang**, X. Meng, and K. Bergman, "Compact and efficient 32Gbps PAM4 segmented vertical junction silicon microdisk modulator," in *Optical Fiber Communication Conference (OFC) 2025*, under review.
- P6 S. Wang, Y. Wang, S. Sanyal, R. Parsons, X. Ji, Y. Okawachi, X. Meng, M. Lipson, A. Gaeta, and K. Bergman, "Automated tuning of ring-assisted MZI based interleaver for Kerr frequency combs," *Optics Letters*, under review.
- P7 **Y. Wang**, S. Wang, P. Dilip, R. Parsons, K. Jang, M. Haimowitz, V. Gopal, A. Novick, A. Rizzo, and K. Bergman, "128-channel DWDM silicon photonic transmitter for > 10 Tbps/mm optical I/O," in preparation.
- P8 Y. Wang, S. Wang, S. Swarnava, N. Nauman, R. Parsons, J. Robinson, M. Hattink, K. Jang, A. Novick, K. J. McNulty, X. Meng, M. Lipson, A. L. Gaeta, and K. Bergman, "Order-preserving channel calibration of Kerr comb-driven microresonator-based DWDM link," in *Optical Fiber Communication Conference (OFC)* 2025, under review.
- P9 T. Zypman, X. Meng, R. Parsons, **Y. Wang**, S. Wang, K. Jang, and K. Bergman, "Silicon photonic MIMO DSP for mode-division multiplexing and multi-dimensional data transmission," *Optics Express*, in preparation.

# Presentation —

**Presentation** SRC TECHCON

Austin, TX, USA

Scalable Kerr-Comb Driven DWDM Silicon Photonics Chip I/O

University Park, PA, USA

**Seminar** School of EECS, Pennsylvania State University Co-Designing Photonics for Heterogeneously Integrated Systems

Apr. 2024

**Invited Talk** SPIE Photonics West

San Francisco, CA, USA

 $Scalable\ Architecture\ for\ Sub-pJ/b\ Multi-Tbps\ Comb-Driven\ DWDM\ Silicon\ Photonic\ Transceiver$ 

Jan. 2023

Sep. 2024

**Poster** Ph.D. Forum, ACM/IEEE Design Automation Conference (DAC)

Online Virtual Event

Design and Optimization of Variation-Aware Runtime-Reconfigurable Optical Interconnects

Jun. 2020

Invited Talk Optical/Photonic Interconnects for Computing Systems (OPTICS) Workshop

Dresden, Germany

Optimal Pairing and Non-Uniform Channel Alignment of Microring-Based Transceivers for Comb Laser–Driven DWDM Silicon Photonics

Mar. 2018

Seminar Department of ECE, Hong Kong University of Science and Technology

Poster Optical/Photonic Interconnects for Computing Systems (OPTICS) Workshop

Jan. 2018

Variation-Aware Modeling and Design of Silicon Photonic Systems

Lausanne, Switzerland

Hong Kong SAR, China

Variation-Aware Modeling and Design of Nanophotonic Interconnects

Mar. 2017

YUYANG WANG CURRICULUM VITAE 3/6

Mentoring -

U: undergraduate; G: graduate

## Songli Wang G

Ph.D. Student at Columbia University

Scalable link architectures, automated post-fabrication tuning Resulting joint publication(s): [J1], [C2], [C3], [C7], [C8], [P8], [P7], [P6], [P5]

# Aneek E. James G

*Ph.D. Student at Columbia University, now with Draper Laboratory* Wafer-scale process variation extraction and characterization Resulting joint publication(s): [C8], [J3], [C9]

# Kaylx Jang G

Ph.D. Student at Columbia University

Dispersion-engineered devices and link budget optimization

Resulting joint publication(s): [C8], [P7]

## Tobias Zypman G

Ph.D. Student at Columbia University Photonics-Enabled Signal Processing Resulting joint publication(s): [P9]

# James Robinson G

Ph.D. Student at Columbia University
Variation-aware tuning of microresonator-based DWDM links
Resulting joint publication(s): [P8]

#### Abidur Rahman U

Undergraduate Student at University of Michigan, Ann Arbor SURE Program of Columbia Engineering for under-represented students Design space exploration of optically connected compute systems

#### Robert Parsons G

Ph.D. Student at Columbia University

Variation-aware modeling and uncertainty quantification Resulting joint publication(s): [J1], [C3], [C7], [C8], [P3], [P7]

## Zhenguo Wu G

*Ph.D. Student at Columbia University*Reconfigurable architecture for optically connected systems
Resulting joint publication(s): [J2], [C4]

#### Nathaniel Nauman G

*Ph.D. Student at Columbia University* Photonics-Enabled Compute for AI Resulting joint publication(s): [P2]

#### Priyanka Dilip G

*Ph.D. Student at Columbia University*Photonics design for testing and design for packaging
Resulting joint publication(s): [P<sub>7</sub>]

#### Max Haimowitz G

Ph.D. Student at Columbia University
Scripted and automated large-scale silicon photonics chip layout
> 80 mm²/reticle fully-scripted layout on a 300 mm full-wafer run

# TEACHING -

U: undergraduate; G: graduate

# Columbia University in the City of New York

- Guest Lecturer ELEN 9404: Seminar in Lightwave Communications G Spring 2024

- Guest Lecturer ELEN 9403: Seminar in Photonics G Spring 2023

## University of California, Santa Barbara

bara Santa Barbara, CA, USA

- Teaching Assistant ECE 153B: Sensor & Peripheral Interface Design U Winter 2019

# LEADERSHIP -

## Center for Ubiquitous Connectivity (CUbiC)

SRC JUMP 2.0

New York, NY, USA

Subgroup Leader, Systems and Testbeds, coordinating four research tasks across three teams
 2024-Present

- CUbiC Scholar Leadership Council, leading monthly workshops with industry liaisons 2023–Present

- Task Co-Lead, Socket-to-Socket Distributed AI/ML/HPC Fabric Platform (SoSFab), photonics system testbed development 2023–Present

YUYANG WANG CURRICULUM VITAE 4/6

- Photonics Lead, DARPA PIPES, in collaboration with Intel, Cornell Univ. (Phase 2) and Orora Design Technologies (Phase 3) 2021-Present
- Design and Aggregation Co-Lead, custom 300 mm wafer run with AIM Photonics involving multiple internal/external riders

2023

# Service ——

# Journal Reviewer

- Nature Nanotechnology, Nature Publishing Group
- APL Photonics, American Institute of Physics
- Journal of Lightwave Technology, IEEE/Optica
- Journal of Selected Areas in Communications, IEEE
- IEEE Transactions on Computers, IEEE
- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, IEEE
- IEEE Transactions on Very Large Scale Integration (VLSI) Systems, IEEE
- IEEE Access, IEEE

## Conference Reviewer

- Optical Fiber Communication Conference (OFC) 2024
- IEEE International Symposium on High-Performance Computer Architecture (HPCA)

# **Under-Represented Student Mentor**

- Summer Undergraduate Research Experience (SURE) Program, Columbia Engineering

2024

2020

#### **Textbook Translation**

- T1 C. Hawkins, J. Segura, and P. Zarkesh-Ha, CMOS Digital Integrated Circuits: A First Course (Chinese Edition), trans. by Y. Wang and Y. Yin. China Machine Press, 2016, original work published by the Institution of Engineering and Technology (IET) in 2013.
- S. Kundu and A. Sreedhar, Nanoscale CMOS VLSI Circuits: Design for Manufacturability (Chinese Edition), trans. by Y. Wang and W. Xie. China Science Publishing, 2014, original work published by McGraw-Hill Education in 2010.

# Award and Honor —

Scholar Leadership Award, Center for Ubiquitous Connectivity (CUbiC) Annual Review	2024
Best Poster Award, voted by liaisons at the Center for Ubiquitous Connectivity (CUbiC) Annual Review	2024
Graduate Fellowship, Department of Electrical and Computer Engineering, University of California, Santa Barba	ara, CA, USA 2015
Outstanding Thesis Award, Department of Electronic Engineering, Tsinghua University, Beijing, China	2015
Scholarship for Sports Excellence, Department of Electronic Engineering, Tsinghua University, Beijing, China	2014

## Reference -

A: from academia; I: from industry

## Keren Bergman A

Director, Columbia Nano Initiative; Charles Batchelor Professor of EE Columbia University in the City of New York

@ bergman@ee.columbia.edu

## Kwang-Ting Cheng A

Vice-President for Research and Development; Chair Professor of EE and CSE Hong Kong University of Science and Technology

@ timcheng@ust.hk

CURRICULUM VITAE 5/6 YUYANG WANG

# Michal Lipson A

Eugene Higgins Professor of EE; Professor of Applied Physics Columbia University in the City of New York

@ ml3745@columbia.edu

# Raymond G. Beausoleil 1

Senior Fellow and Senior Vice President Hewlett Packard Enterprise

@ ray.beausoleil@hpe.com

# John E. Bowers A

Director, Institute for Energy Efficiency; Distinguished Professor of ECE University of California, Santa Barbara

@jbowers@ucsb.edu

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