Alexander N. Tait

atait@ieee.org
taitphotonlab.com @taitphotonlab
Google scholar; GitHub Brooklyn, NY

EXPERIENCE

Queen's University, Assistant Professor (2021-2025)
National Institute of Standards and Technology, Electrical Engineer (2020-2021)
National Institute of Standards and Technology, NRC Postdoctoral Fellow (2018-2020)
Princeton U., Lightwave Research Laboratory, Graduate Research Assistant (2012-2018)
Princeton U., "Photonics and Lightwave Communications," Teaching Assistant (Spring 2015)
Princeton Power Systems, Test Engineer (part time) (2009-2010)
U. of Rochester, Laboratory for Laser Energetics, Experimental Assistant (2007-2009, Summers)

ACTIVE RESEARCH AREAS

Neuromorphic photonics, Cryogenic silicon photonics

EDUCATION

Princeton University, Princeton, NJ
2018 Ph.D. Electrical Engineering, Princeton University (Advisor: Paul R. Prucnal)
2014 M.S. Electrical Engineering, Princeton University
2012 B.S.E. Electrical Engineering, *cum laude*, Princeton University
Ecole Centrale Paris, Paris, France
2010 Exchange Student (semester S3).

GRANT WRITING EXPERIENCE

Principal Investigator

National Science and Engineering Research Council (NSERC), Discovery Grants. Neuromorphic Photonic Operating Systems. 4/22 – 3/27. CAD$177,500. (**awarded**)
Canadian Foundation for Innovation (CFI), John Evans Leaders Fund (JELF). Quantum Internet to the Home with Cryogenic Photonics. 10/22 – 9/27. CAD$250,000. (**awarded**)
Canadian Microelectronics Corporation (CMC). Cryogenic Sources, Detectors, and Design Kit (IPHQUCDK). 2022. In-kind CAD$14,000. (**awarded**)
NSERC, Catalyst Grants. Cryogenic Photochromics for Parallel Programming of Large-scale Integrated Photonic Systems. 1 year duration. CAD$35,000. (not awarded)
NSERC, Alliance Grants. PICQLES: Photonic Integrated Circuits for Quantum Light Emitters in Silicon. 5 year duration. CAD$1,500,000. (not awarded)
National Science Foundation (NSF). ChipRACE: Chip-scale Real-time Artificial Intelligence Classification Engine. 2 year duration. $1,200,000. (not awarded)

Co-Principal Investigator (awarded)

NSERC, CREATE. Network for Ultrafast Computing with Light on Emerging Unconventional Semiconductors (NUCLEUS). 9/24 – 8/30. CAD$1,650,000.

Co-writer (awarded)

National Science Foundation (NSF). EARS: Collaborative Research: Blind Source Separation with Integrated Photonics, 10/16 – 9/19. $900,000.
Defense Advanced Research Projects Agency (DARPA). Hyper Control, 11/14 – 10/15. $500,000.
National Science Foundation (NSF). E2CDA: Type I: Collaborative Research: Nanophotonic Neuromorphic Computing, 10/17 – 9/20. $900,000 (link to collaborator grant)
Office of Naval Research (ONR). Energy Efficient and Low Latency Photonic Signal Processing using Excitable Lasers with Compressive Sampling, 6/17 – 5/20. $150,000.
Office of Naval Research (ONR). Fiber Optic Detection of Magnetic Flux Quantum Pulses using Resonator-Enhanced Modulation, 3/16 – 2/18. $450,000.

Princeton University J. Insley Blair Pyne Fund. Implementation of a Bio-inspired Time Invariant Recognition Algorithm in High Speed Photonics, 10/13 – 9/16. $75,000.

TEXTBOOK

P. Prucnal and B. Shastri. Neuromorphic Photonics, CRC press, May. 2017. (contributor)

AWARDS

National Academy of Sciences, NRC Postdoctoral Fellowship (2018)
IEEE Photonics Society, Graduate Student Fellowship (2017)
Princeton University School of Engineering and Applied Science, Award for Excellence (2016)
IEEE Summer Topicals Meeting Series, Best Student Paper Award (2016)
Princeton University/McKinsey Case Competition, Outstanding Quantification Award (2013)
National Science Foundation (NSF), Graduate Research Fellowship (2012)
Princeton English Dept., Class of 1883 Award for best English essay by a freshman engineer (2009)

JOURNAL ARTICLES

citations: 11,000+ h-index: 47 i10-index: 87

first author (top three: 2, 5, 8)

1. Quantifying power in silicon photonic neural networks, *Phys. Rev. Applied* **17**(p. 054029). May 2022.
2. Photonics for artificial intelligence and neuromorphic…, *Nat. Photon.* **15**(2). Jan. 2021. (equal first author)
3. Microring resonator-coupled photoluminescence from silicon W centers, *J. Phys Photonics*, **2**(4). Jul. 2020.
4. Demonstration of Multivariate Photonics: blind dimensionality…, *J. Lightwave Technol.*, **37**(24). Oct. 2019.
5. Silicon photonic modulator neuron, *Phys. Rev. Applied*, **11**(p. 064043). Jun. 2019.
6. Feedback control for microring weight banks, *Opt. Express*, **26**(20). Oct. 2018.
7. Two-pole microring weight banks, *Opt. Lett.*, **43**(10). May 2018.
8. Neuromorphic photonic networks using silicon photonic weight banks, *Sci. Rep.,* **7**(7430), Aug. 2017.
9. Microring weight banks, *J. Sel. Top. Quantum Electron.* **22**(6), Dec. 2016.
10. Multi-channel control for microring weight banks, *Opt. Express*, **24**(8), Apr. 2016.
11. Continuous calibration of microring weights for analog optical…, *Photonics Technol. Lett.*, **28**(8), Jan. 2016.
12. Demonstration of WDM weighted addition for principal component…, *Opt. Express*, **23**(10), May 2015.
13. Broadcast-and-weight: an integrated network for scalable…, *J. Lightwave Technol.*, **32**(21), Nov. 2014.
14. Photonic neuromorphic signal processing and computing, *Nanophotonic Information Physics*. Springer, 2014.
15. The DREAM: An integrated photonic thresholder, *J. Lightwave Technol.*, **31**(8), Apr. 2013.

co-author (top three: 16, 23, 33)

16. P. Allo et al. Photoluminescent colour centres on a mainstream silicon photonic…. arXiv:2503.17610
17. N. Al-Kayed et al. Programmable 200 GOPS Hopfield-inspired photonic... *Nature* **648**(8094), Dec. 2025.
18. A. Khaled et al. Fully integrated hybrid multimode-multiwavelength…. *Nat. Comm.* **17**(28), Dec. 2025.
19. Z. Guo et al. Analog end-to-end adaptive training with locally-updated physical. arXiv:2506.18041
20. M. Tamura et al. Design of a monolithic silicon-on-insulator resonator…. *Comm. Phys.* **7**(1), Sep. 2024.
21. H. Morison et al. Nonlinear dynamics in neuromorphic photonic…. *Phys. Rev. App.* **21**(3), Mar. 2024.
22. W. Zhang et al. A system-on-chip microwave photonic processor…. *Light: Sci. & Apps.* **13**(1), Jan. 2024.
23. W. Zhang et al. Broadband physical layer cognitive radio with an…. *Nat. Comm.* **14**(1), Feb. 2023.
24. S. Buckley et al. Photonic online learning: a perspective. *Nanophotonics* **12**(5), Jan. 2023.
25. S. Khan et al. Superconducting optoelectronic single-photon synapses. *Nat. Electron.* **5**(10), Oct. 2022.
26. L. Xu et al. Scalable networks of neuromorphic photonic…. *J. Sel. Top. Quantum Electron.* **28**(6), Oct. 2022.
27. R. Soref et al. The silicon-based XOI wafer: the most…. *J. Sel. Top. Quantum Electron.* **29**(2), Oct. 2022.
28. Z. Guo et al. Multi-level encoding and decoding in a…. *J. Sel.Top. Quantum Electron.* **28**(6), Aug. 2022.
29. T. Lima et al. Design automation of photonic resonator weights. *Nanophotonics*, **11**(17), Apr. 2022.
30. C. Huang et al. High-Capacity space-division multiplexing communications…. *Optica* **40**(6), Mar. 2022.
31. C. Huang et al. Prospects and applications of photonic neural…. *Adv. In Phys. X* **7**(1), Sep. 2021.

32. A. McCaughan et al. PHIDL: Python-based layout and geometry…. *J. Vacuum Sci.* **39**(062601), Sep. 2021.
33. S. Buckley et al. Integrated photonic characterization of single-photon…, *PR Applied*, **14**(5), Jan. 2021.
34. Y. Ma et al. Blind source separation with integrated photonics…, *Opt. Lett.,* **45**(23), Dec. 2020.
35. K. Berggren et al. Roadmap on emerging hardware and technology…, *Nanotech.,* **4** 012002, Oct. 2020.
36. T. Lima et al. Primer on silicon neuromorphic photonic processors…, *Nanophotonics*, **9** (13), Oct. 2020.
37. B. Marquez et al. Silicon photonics for artificial intelligence…, *Photoniques*, **104** pp. 40-44, Sep. 2020.
38. C. Huang et al. On-Chip Programmable Nonlinear Optical…, *J. Sel. Top. Quantum Electron.* May 2020.
39. S. Buckley et al. Optimization of photoluminescence from W centers…, Opt. Express **28**(11), May 2020.
40. A. Jha et al. Lateral bipolar junction transistor on a silicon photonics…, *Opt. Express*, **28**(8), Apr. 2020.
41. C. Huang et al. Demonstration of scalable microring weight bank…, *APL Photonics* **5**(4), Apr. 2020.
42. Y. Ma et al. Photonic independent component analysis using an on-chip…, *Opt. Express* **28**(2), Jan. 2020.
43. M. Nahmias et al. Photonic multiply-accumulate operations for…, *J. Sel. Top. Quantum Electron.* Sep. 2019.
44. C. Huang et al. Programmable silicon photonic optical…, *Photonics Technol. Lett.*, **31**(22), Nov. 2019.
45. A. McCaughan et al. A superconducting thermal switch with ultrahigh…, *Nat. Electron.*, **2**(10), Sep. 2019.
46. V. Bangari et al. Digital Electronics and Analog Photonics…, *J. Sel.Top. Quantum Electron.* **26**(1), Oct. 2019
47. R. Amin et al. ITO-based electro-absorption modulator for photonic…, *APL Materials,* **7**(8), Aug. 2019.
48. T. Lima et al. Noise analysis of photonic modulator neuron, *J. Sel. Top. Quantum Electron.*, **26**(1), Jul. 2019.
49. H.-T. Peng et al. Temporal information processing with…, *J. Sel. Top. Quantum Electron.*, **26**(1), Jul. 2019.
50. P. Ma et al. Photonic principal component analysis using an on-chip…, *Opt. Express,* **27**(13), Jun. 2019.
51. L. Chrostowski et al. Silicon Photonic Circuit Design..., *J. Sel. Top. Quantum Electron.*, **25**(5), May 2019.
52. T. Lima et al. Machine Learning with Neuromorphic Photonics, *J. Lightwave Technol.*, **37**(5), Mar. 2019.
53. J. George et al. Neuromorphic photonics with electro-absorption…, *Opt. Express*, **27**(4), Feb. 2019.
54. P. Ma et al. Steganographic communication via spread optical…, *J. Lightwave Technol.*, **36**(23), Dec. 2018.
55. P. Ma et al. Simultaneous excitatory and inhibitory dynamics in an excitable laser, **43**(15), Aug. 2018.
56. H.-T. Peng et al. Neuromorphic photonic integrated…, *J. Sel. Top. Quantum Electron.*, **24**(6), May 2018.
57. T. Lima et al. Progress in neuromorphic photonics, *Nanophotonics*, **6**(3), Mar. 2017.
58. B. Shastri et al. Spike processing with a graphene excitable laser, *Sci. Rep.*, **5**(19126), Jan. 2016.
59. P. Prucnal et al. Recent progress in semiconductor excitable lasers…, *Adv. Opt. Photon.*, **8**(2), Jun. 2016.
60. T. Lima et al. Scalable wideband principal component analysis…, *IEEE Photonics Journal*, **8**(2), Apr. 2016,
61. M. Nahmias et al. An integrated analog O/E/O link for multi-channel…, *Appl. Phys. Lett.*, **108**(15), 2016.
62. R. Toole et al. Photonic implementation of spike-timing-dependent…, *J. Lightwave Technol.*, **34**(2), 2016.
63. M. Nahmias et al. Excitable laser processing network node in hybrid…,*Opt. Express*, **23**(20), Oct. 2015,
64. M. Nahmias et al. Normalized pulsed energy thresholding in a nonlinear…, *Appl. Opt.*, **54**(11), Apr. 2015.
65. B. Wu et al. Optical signal processing and stealth transmission…, *J. Sel. Top. Signal Proc.,* **9**(7), Oct. 2015.
66. B. Shastri et al. SIMPEL: Circuit model for photonic spike processing laser…, *Opt. Express*, **23**(6), 2015.
67. B. Wu et al. WDM optical steganography based on amplified spontaneous…, *Opt. Lett.*, **39**(20), 2014.
68. M. Nahmias et al. A leaky integrate-and-fire laser neuron…, *J. Sel. Top. Quantum Electron.*, **19**(5), 2013.
69. N. Rafidi et al. Power transfer function tailoring in a highly…, *IEEE Photonics Journal*, **4**(2), Apr. 2012.
70. M. Fok et al. Signal feature recognition based on lightwave neuromorphic…, *Opt. Lett.*, **36**(1), 2011.
71. Y. Liang et al. The homemaker's hydrogen generator: A report…, *Intl. J. Hydrogen Energy*, **36**(21), 2011.
72. S. Papernov et al. Near-ultraviolet absorption and nanosecond-pulse-…, *J. Appl. Phys.*, **109**(11), 2011.

CONFERENCE PRESENTATIONS

invited

1. Quantifying resolution and power use in integrated photonic accelerators, *Summer Topicals (***SUM***)*, 2022.
2. Neuromorphic Photonics Based on Silicon Microring Devices and Networks, **OECC/PSC**, 2022.
3. Progress in the Applications of Silicon Photonic…, *Conference on Lasers and Electrooptics (**CLEO**),* 2022.
4. Neuromorphic silicon photonics: principles… [Tutorial], *Euro. Conf. Optical Comm.* (**ECOC**), Dec. 2021.
5. Neuromorphic silicon photonics: principles…, *MIT Optics and Quantum Electron. Series* (**OQE**), Oct. 2021.
6. Neuromorphic silicon photonics on emerging…, *European Conf. on Optical Comm.* (**ECOC**), Dec. 2020.
7. Silicon photonics as a platform for cryogenic and…, *SUNY Poly. Spring Colloquium Series*, Mar. 2020.
8. Microresonator-enhanced, waveguide-coupled emission…, *Optical Fiber Conference (**OFC**)*, Mar. 2020.

9. Neuromorphic silicon photonics on foundry and cryogenic platforms, *Summer Topicals (**SUM**)*, 2019.
10. Superconducting optoelectronics for quantum and neuromorphic…, *RIT Photonics for Quantum*, 2019.
11. Photonic microrings, neural networks, and procedural layout, *SiEPIC Silicon Photonic Passives*, 2018.
12. Microring weight banks for neuromorphic silicon…, *Conference on Lasers and Electrooptics (**CLEO**),* 2018.

contributed

13. Blind source separation in the physical layer, In *Conf. on Information Sciences and Systems (**CISS**)*, Mar. 2018.
14. Microring weight bank designs with improved channel…, *International Photon. Conf. (**IPC**)*, Oct. 2017.
15. Application regime and distortion metric for multivariate RF…, *Optical Interconnects (**OIC**)*, Jun. 2017.
16. Silicon microring weight banks for multivariate RF photonics, ***CLEO***, May. 2017.
17. Demonstration of a silicon photonic neural network, ***SUM***, Jul. 2016.
18. Multi-channel microring weight bank control for reconfigurable optical…, ***OIC***, May 2016.
19. Continuous control of microring weight banks, ***IPC***, Oct. 2015.
20. Balanced WDM weight banks for analog optical processing and..., ***SUM***, Jul. 2015.
21. Broadcast-and-weight interconnects for integrated distributed processing, ***OIC***, May 2014.
22. A dual resonator enhanced asymmetric Mach-Zehnder…, In *Optical MEMS and Nanophotonics*, Aug. 2012.

PATENTS

issued

C. Huang, T. Ferreira de Lima, A. Tait, S. Abbaslou, A. Jha, B. Shastri, P. Prucnal, M. Nahmias, H.-T. Peng. System and Method for Programmable Nonlinear Silicon Photonic Circuit. U.S. Patent No. 2021/ 11187963B2. 2021.

A. Tait, A. Wu, T. Ferreira de Lima, M. Nahmias, B. Shastri, P. Prucnal. Photonic Filter Bank System and Method of Use. U.S. Patent No. 2019/0331912A1. 2019.

A. Tait, M. Nahmias, B. Shastri, P. Prucnal. System and Method for Photonic Processing. U.S. Patent No. 2017/0302396A1. 2017.

filed or disclosed

A. Tait, E. Gordon, M. Nahmias, T. Ferreira de Lima, B. Shastri, P. Prucnal. System and Method for Mode-based Photonic Processing. 62/844,435. 2019.

M. Nahmias, T. Ferreira de Lima, A. Tait, B. Shastri, P. Prucnal. Optically Accelerated FPGA and Method of Use. 62/869,096. 2019.

A. Tait, M. Nahmias, T. Ferreira de Lima, B. Shastri, P. Prucnal. Nonlinear Remodulation Unit with Electronic Amplification. 62/690,425. 2018. (a.k.a. modulator neuron)

A. Tait, M. Nahmias, T. Ferreira de Lima, P. Y. Ma, H.-T. Peng, B. Shastri, P. Prucnal. Feedback Control for Microring Weight Banks. 62/719,516. 2018.

A. Tait, A. X. Wu, T. Ferreira de Lima, M. Nahmias, B. Shastri, P. Prucnal. Design of High Channel Count Two-Pole Microring Weight Banks. 62/664,386. 2018.

M. Nahmias, H.-T. Peng, T. Ferreira de Lima, A. Tait, B. Shastri, P. Prucnal. Excitable Laser Processor in a III-V Photonic Integrated Circuit Platform, 62/663,057. 2018.

M. Nahmias, H.-T. Peng, T. Ferreira de Lima, A. Tait, B. Shastri, P. Prucnal. Photonic circuit total laboratory automation, data management and virtualization. 62/669,097 2018.

M. Nahmias, T. Ferreira de Lima, A. Tait, B. Shastri, P. Prucnal. Photonic Tensor Machine. 62/647,393. 2018.

OPEN-SOURCE CONTRIBUTIONS

creator

klayout-gadgets: Tools to make klayout and python work better together [**>230,000 downloads**]
klayout-ipc: Inter-process control for klayout [**>130,000 downloads**]
lytest: Automated geometry testing for klayout and phidl [**>160,000 downloads**]
lymask: Mask dataprep with klayout [**>40,000 downloads**]
lightlab: A python library for remote laboratory control
SOEN-PDK: process design kit for NIST superconducting optoelectronic technologies

jupyter-meep: Notebook-based MEEP with convenience and examples
Quantifying Power in Silicon Photonic Neural Networks: efficiency calculator and roadmapping tool contributor
nengo: A Python library for creating and simulating large-scale brain models
nengo-ocl: OpenCL-based Nengo Simulator
pypragma: Python code transformers that mimic pragma compiler directives
phidl: Python GDS layout and CAD geometry creation
xsection: cross-section generator for KLayout VLSI layouts
kicad-python: Wrapper and environment management for open-source PCB layout application

INTEGRATED PHOTONICS TAPEOUTS

Princeton in-house: 8 sole designer and fabricator
Silicon photonic prototyping: 6 sole designer
NIST cleanroom: 3 lead designer, 3 contributing designer
IME A*STAR: 2 lead designer, 3 contributing designer, 1 in progress
JePPiX/HHI: 1 contributing designer
SUNY Poly: 1 lead designer