

**Tianyu Wang**

U.S. permanent resident

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[Google scholar profile](#) | [GitHub](#) | [LinkedIn](#)**RESEARCH INTEREST**

Optical information processing | Biomedical optics | Artificial intelligence for sciences

**EDUCATION**

- Cornell University, Ithaca, NY, USA Aug 2012-Aug 2018  
**Ph.D. in Applied and Engineering Physics** *Advisor: [Chris Xu](#)*  
 ▷Dissertation: Calcium Imaging with Three-photon Microscopy in the Mouse Brain
- Cornell University, Ithaca, NY, USA Aug 2010-May 2012  
**B.S. in Biological Engineering, Summa Cum Laude**
- Shanghai Jiao Tong University, Shanghai, China Sep 2008-Jun 2010  
*School of Physics and Astronomy*

**APPOINTMENTS**

- Boston University, Boston, MA, USA Jan 2024 –  
**Assistant Professor in Electrical and Computer Engineering**
- Cornell University, Ithaca, NY, USA 2019-2023  
**Postdoctoral Associate in Applied Physics** | *Supervisor: [Peter L. McMahon](#)*
- Mong Senior Cornell Neurotech Fellow** 2018-2020

**HONORS AND AWARDS**

- Peter J. Levine Career Development Professor 2024-2027
- Schmidt AI in Science Postdoctoral Fellowship 2022-2023
- SPIE Photonic West “JenLab Young Investigator Award” Jan 2017
- Cornell Presidential Life Sciences Fellowships 2012-2013
- Cornell Biological & Environmental Engineering Class 2012 Spotlights May 2012

**PUBLICATIONS***First-Author and Co-First-Author Papers*

1. **T. Wang**. “A nonlinear dimension for machine learning in optical disordered media.” *Nature Computational Science* (2024)
2. **T. Wang\***, M. M. Sohoni\*, L. G. Wright, M. M. Stein, S.-Y. Ma, T. Onodera, M. G. Anderson, and P. L. McMahon. “Image sensing with multilayer, nonlinear optical neural networks.” *Nature Photonics* **17**, 408-415 (2023)
3. **T. Wang**, S.-Y. Ma, L. G. Wright, T. Onodera, B. C. Richard, and P. L. McMahon. “An optical neural network using less than 1 photon per multiplication.” *Nature Communications* **13**, 123 (2022)
4. **T. Wang** and C. Xu. “Three-photon neuronal imaging in deep mouse brain.” *Optica* **7**, 947–960 (2020)
5. **T. Wang\***, C. Wu\*, D. G. Ouzounov, W. Gu, F. Xia, M. Kim, X. Yang, M. R. Warden, and C. Xu. “Quantitative analysis of 1300-nm three-photon calcium imaging in the mouse brain.” *Elife* **9**, e53205 (2020)
6. **T. Wang**, D. G. Ouzounov, C. Wu, N. G. Horton, B. Zhang, C-H. Wu, Y. Zhang, M. J. Schnitzer, and C. Xu. “Three-photon imaging of structure and function through the intact mouse skull.” *Nature Methods* **15**, 789-792 (2018)

7. D. G. Ouzounov\*, **T. Wang\***, M. Wang, D. D. Feng, N. G. Horton, J. C. Cruz-Hernández, Y-T. Cheng, J. Reimer, A. S. Tolia, N. Nishimura, and C. Xu. “In vivo three-photon imaging of activity of GCaMP6-labeled neurons deep in intact mouse brain.” *Nature Methods* **14**, 388–390 (2017)

#### Other Papers

1. T. Onodera, M. M. Stein, B. A. Ash, M. M. Sohoni, M. Bosch, R. Yanagimoto, M. Jankowski, T. P. McKenna, **T. Wang**, G. Shvets, M. R. Shcherbakov, L. G. Wright, and P. L. McMahon. “Arbitrary control over multimode wave propagation for machine learning.” *Nature Physics* (2025).
2. S. Lee, S. Ghajari, S. Sadeghi, Y. Zheng, H. Zahr, A. J. Cortese, W. Gu, K. Choe, A. Mok, M. Wallace, R. Jiao, C. Wu, J. C. Werth, W. Fan, P. Mogalipuvvu, J. U. Park, S. Zhao, C. Smart, T. A. Cleland, M. R. Warden, J. Lammerding, **T. Wang**, J. H. Goldberg, P. L. McEuen, C. Xu, & A. C. Molnar. “A sub-nanoliter tetherless optoelectronic microsystem for chronic neural recording in awake mice.” *Nature Electronics* **8**, 1259-1271 (2025).
3. MICrONS Consortium. “Functional connectomics spanning multiple areas of mouse visual cortex.” *Nature* **640**, 435-447 (2025).
4. L. Abou-Hamdan, E. Marinov, P. Wiecha, P. del Hougne, **T. Wang**, & P. Genevet. “Programmable metasurfaces for future photonic artificial intelligence.” *Nature Reviews Physics*, 1-17 (2025).
5. S.-Y. Ma, T. Wang, J. Laydevant, L. G. Wright, & P. L. McMahon. “Quantum-limited stochastic optical neural networks operating at a few quanta per activation.” *Nature Communications* **16**, 359 (2025)
6. V. Cimini, *et al.* “Large-scale quantum reservoir computing using a Gaussian Boson Sampler.” *arXiv preprint:2505.13695* (2025).
7. A. T. Mok, **T. Wang**, S. Zhao, K. E. Kolkman, D. Wu, D. G. Ouzounov, C. Seo, C. Wu, J. R. Fetcho, & C. Xu. “A large field-of-view, single-cell-resolution two- and three-photon microscope for deep and wide imaging.” *eLight* **4**, 20 (2024)
8. F. Presutti, L. G. Wright, S.-Y. Ma, **T. Wang**, B. K. Malia, T. Onodera, and P. L. McMahon. “Highly multimode visible squeezed light with programmable spectral correlations through broadband up-conversion.” *preprint on arXiv: 2401.06119* (2024)
9. M. G. Anderson, S.-Y. Ma, **T. Wang**, L. G. Wright, and P. L. McMahon, “Optical transformers” *Transactions on Machine Learning Research* (2024)
10. J. Laydevant, L. G. Wright, **T. Wang**, P. L. McMahon, “Hardware is the software” *Neuron* **112**, 180-183 (2024)
11. D. Sinefeld, F. Xia, M. Wang, **T. Wang**, C. Wu, X. Yang, H. P. Paudel, D. G. Ouzounov, T. G. Bifano, and C. Xu, “Three-Photon Adaptive Optics for Mouse Brain Imaging.” *Frontiers in Neuroscience* **16**, 880859 (2022)
12. K. Choe, Y. Hontani, **T. Wang**, E. Hebert, D. G. Ouzounov, K. Lai, A. Singh, W. Béguelin, A. Melnick, and C. Xu. “Intravital three-photon microscopy of mouse lymph node over the entire depths.” *Nature Immunology* **23**, 330-340 (2022)
13. L. G. Wright\*, T. Onodera\*, M. M. Stein, **T. Wang**, D. T. Schachter, Z. Hu, and P. L. McMahon. “Deep physical neural networks enabled by a backpropagation algorithm for arbitrary physical systems.” *Nature* **601**, 549-555 (2022)
14. A. J. Cortese, C. L. Smart, **T. Wang**, M. F. Reynolds, S. L. Norris, Y. Ji, S. Lee, A. Mok, C. Wu, F. Xia, N. I. Ellis, A. C. Molnar, C. Xu, and P. L. McEuen. “Microscopic sensors using optical wireless integrated circuits.” *Proceedings of the National Academy of Sciences* **117**, 9173–9179 (2020)

15. S. Lee, A. J. Cortese, A. Mok, C. Wu, **T. Wang**, J. U. Park, C. Smart, S. Ghajari, D. Khilwani, S. Sadeghi, Y. Ji, J. H. Goldberg, C. Xu, P. L. McEuen, and A. C. Molnar. “Fabrication of Injectable Micro-Scale Opto- Electronically Transduced Electrodes (MOTEs) for Physiological Monitoring.” *Journal of Microelectromechanical Systems* **29**, 1–7 (2020)
16. D. G. Ouzounov, **T. Wang**, C. Wu, and C. Xu. “GCaMP6  $\Delta F/F$  dependence on the excitation wavelength in 3-photon and 2-photon microscopy of mouse brain activity.” *Biomedical Optical Express* **10**, 3343 (2019)
17. G. Rasskazov\*, A. Ryabtsev\*, K. Charan, **T. Wang**, C. Xu, and M. Dantus. “Characterization and adaptive compression of a multi-soliton laser source.” *Optics Express* **25**, 320 (2017)
18. Y. Tang, L. G. Wright, K. Charan, **T. Wang**, C. Xu, and F. W. Wise. “Generation of intense 100 fs solitons tunable from 2 to 4.3  $\mu\text{m}$  in fluoride fiber.” *Optica* **3**, 948–951 (2016)

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### INVITED TALKS

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- “Computing and Sensing with Photons”, *University of Arizona*, Tucson, AZ, U.S.A., Oct 24, 2024
- “Optical-neural-network smart sensors: computing and sensing in the optical domain”, *TTI/Vanguard Conference*, Half Moon Bay, CA, U.S.A., Dec 12, 2023
- “Optical-neural-network smart sensors: computing and sensing in the optical domain”, *Boston University*, Boston, MA, U.S.A., Feb 14, 2023
- “Energy scaling of optical neural networks”, *SPIE Photonic West*, San Francisco CA, U.S.A., Jan 30, 2023
- “Optical-neural-network smart sensors: computing and sensing in the optical domain”, *Washington University at St. Louis*, St. Louis, MO, U.S.A., Jan 27, 2023
- “From three-photon neuronal imaging to machine learning with light: a path towards smart microscopy”, *European Molecular Biology Laboratory, Heidelberg*, online, Oct 17, 2022
- “Deep learning in the optical domain: computing and sensing with optical neural networks”, *Ecole Normale Supérieure in Paris*, online, Sep 21, 2022
- “Sensing beyond imaging: from end-to-end optimization of neuronal imaging to optical neural networks”, *Electrical and Computer Engineering, University of California, Riverside*, online, Aug 22, 2022
- “Deeper, faster, and smarter optical microscopy for neural imaging”, *Institute of Neuroscience, Chinese Academy of Sciences*, online, May 20, 2021
- “The path towards large-volume neuronal imaging with three-photon microscopy”, *Panelist for OSA Imaging Optical Design Group*, online, Aug 31, 2020
- “Quantitative study of three-photon microscopy for calcium imaging”, *Neuralink*, San Francisco, California, U.S.A., Mar 2, 2018
- “Quantitative characterization of two-photon and three-photon calcium imaging: Why three-photon can image deeper?” *12<sup>th</sup> Workshop on Advanced Multiphoton and Fluorescence Lifetime Imaging Techniques FLIM 2017*, Max Born Institute, Berlin, Germany, Jun 30, 2017
- “Quantitative characterization of two-photon and three-photon calcium imaging: Why three-photon can image deeper?” *Neuroscience Symposium, Baylor College of Medicine*, Houston, Texas, U.S.A., Jun 22, 2017

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### SELECTED PRESENTATIONS

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- “Image sensing with nonlinear optical neural networks”, *Stanford University*, Stanford, California, U.S.A., May 20, 2022
- “Image sensing with nonlinear optical neural networks”, *University of California, Berkeley*, Berkeley, California, U.S.A., May 19, 2022

- “An optical neural network operating with less than 1 photon per multiplication”, *Frontiers in Optics + Laser Science*, online talk, Nov 4, 2021
- “A photonic neural network using  $< 1$  photon per scalar multiplication”, *Hot Chips 2021*, online poster, Aug 22-24, 2021
- “An optical neuromorphic processor using  $< 1$  photon per scalar multiplication”, *Workshop on Deep Learning in Unconventional Neuromorphic Hardware, IJCNN 2021*, online talk, Jul 23, 2021
- “Quantitative comparison of two-photon and three-photon activity imaging of GCaMP6s-labeled neurons in vivo in the mouse brain”, *Optics in the Life Sciences Congress*, San Diego, California, U.S.A., Apr 4, 2017
- “In vivo three-photon activity imaging of GCaMP6-labeled neurons in deep cortex and the hippocampus of the mouse brain”, *SPIE Photonic West*, San Francisco, California, U.S.A., Jan 16, 2017

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### SERVICE

Reviewer for *Nature*, *Nature Photonics*, *Nature Nanotechnology*, *Nature Machine Intelligence*, *Nature Computational Science*, *Nature Communications*, *Science Advances*, *Light: Science and Applications*, *Communication Physics*, *Frontiers in Neuroscience*, *Optica*, *Photonics Research*, *Optics Letter*, *Optics Express*, *Journal of Biophotonics*, *Biomedical Optics Express*.

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### TEACHING

Instructor for EC 500 AI methods in Photonics	Fall 2025
Instructor for EK 307 Electric Circuits	Spring 2024, 2025
Instructor for EC 770 Waveguide Optoelectronic Devices	Fall 2024

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### GRANTS

Kavli Institute at Cornell Instrumentation Projects (\$20,000)	2021-2022
Sponsored Research Program – Ayo Electronics Inc. (\$64,000)	2025
Chan-Zuckerberg Initiative: Deep-tissue Imaging – Phase 2 (co-PI, \$2.5M)	2024-2028

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### PATENTS

U.S. Patent (Appl. No. 17/670,232) – Systems and Methods for Optical Matrix-vector Multiplication  
 U.S. Patent (Appl. No. 18/656,563) – Optical Pulse Generator and Methods  
 U.S. Patent (Appl. No. PCT/US2023/028613) – Optical Sensing with Nonlinear Optical Neural Networks