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# Tianyi Wu

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## EDUCATION

**School of Mathematical Sciences, Peking University**

Sept. 2017 - Jul. 2022

- B.S. in Mathematics, majoring in *Information and Computational Sciences*
- Cumulative GPA: 3.6/4.0

**Selected Coursework:** Functions of Real Variables, Functions of Complex Variables, Functional Analysis, Ordinary Differential Equations, Qualitative Theory of Ordinary Differential Equations, Partial Differential Equations, Information Theory, Stochastic Analysis and Applications, Computational Neuroscience, Data Structures and Algorithms, etc.

### Honors and Awards:

Merit Student of Peking University	2018
Excellent Freshman Scholarship	2017
Gold Medal in the 30 <sup>th</sup> Chinese Chemistry Olympiad	2016

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## PREPRINTS AND PUBLICATIONS

### Model Reduction Captures Stochastic Gamma Oscillations on Low-Dimensional Manifolds

*Frontiers in Computational Neuroscience*, 2021

Yuhang Cai, **Tianyi Wu**, Louis Tao, Zhuo-Cheng Xiao

Link: <https://www.frontiersin.org/articles/10.3389/fncom.2021.678688/full>

### Multiband Oscillations Emerge from a Simple Spiking Network

*In preparation*

**Tianyi Wu**, Yuhang Cai, Ruilin Zhang, Zhongyi Wang, Louis Tao, Zhuo-Cheng Xiao

Link: <https://github.com/NickelRaney/Multiband-Paper/blob/main/GammaMultiBand.pdf>

### Light Activation of Intrinsically Photosensitive Retinal Ganglion Cells Improves Visual Orientation Perception

*In preparation*

Yiming Shi et al (**Tianyi Wu** shares the authorship)

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## RESEARCH EXPERIENCE

### Convergence Properties of Data-Informed Mean-Field Model for Cortical Dynamics

July. 2021 - Present

Advisor: Professor Kevin K Lin, School of Mathematical Sciences, University of Arizona

- Analyze the properties of a new mean-field (MF) method, which has been shown to accurately reproduce the behavior of a detailed network model at a small fraction of the computational cost, to improve its performance.<sup>1</sup>

### Multiband Oscillations Emerge from a Simple Spiking Network

Jun. 2021 - Sep. 2021

Advisors: Professor Louis Tao, Academy for Advanced Interdisciplinary Studies, Peking University

Dr. Zhuo-Cheng Xiao, Courant Institute of Mathematical Sciences, New York University

- Found repeating spiking patterns temporal sequence resulting in multiband oscillation. Typical sequences in this pattern include alternating strong and weak periods, which inspired our modeling.
- Proposed an iterative map of the excitatory-inhibitory voltage gap for explanations. This iterative map method provides a powerful toolbox for other regular or irregular oscillation behavior.

### Model Reduction Captures Stochastic Gamma Oscillations on Low-Dimensional Manifolds

Jun. 2020 - Nov. 2020

Advisors: Professor Louis Tao, Academy for Advanced Interdisciplinary Studies, Peking University

Dr. Zhuo-Cheng Xiao, Courant Institute of Mathematical Sciences, New York University

- Provided a group of reduced models to capture the dynamical feature of Gamma oscillations and revealed the crucial dynamical conditions by the stationary distribution, simplifying the established Markovian model, which is high-dimensional and complex to perform analysis.

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<sup>1</sup>Xiao Z.-C., Lin, K. K., & Young, L.-S. (2021) A data-informed mean-field approach to mapping of cortical parameter landscapes. *Eprint*, [arXiv: 2110.12286](https://arxiv.org/abs/2110.12286).

- This two-step reduction method has the potentials for more complex brain dynamics, for instance, the coupling of neural oscillations of different frequencies and brain regions.

## Light Activation of Intrinsically Photosensitive Retinal Ganglion Cells Improves

### Visual Orientation Perception

Apr. 2020 - Aug. 2020

Advisor: *Professor Louis Tao, Academy for Advanced Interdisciplinary Studies, Peking University*

Collaborator: *Professor Tian Xue, School of Life Sciences, University of Science and Technology of China*

- Constructed a modified classic ring model that successfully captures ipRGC neurons' function in orientation selectivity and contrast sensitivity.<sup>2</sup>
- Proposed a more delicate model with adaptive synapse, which further captured the adaptation effects under fixed/random order of stimuli to some extent.

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## INDUSTRIAL EXPERIENCE

### BodyPark, an A.I. Fitness Startup

Beijing, China

Intern, Algorithm Division

Dec. 2020 - Mar. 2021

- Worked on projects concerning motion transfer, keypoints detection and fisheye detection.
- Combined newly published deep learning methods with my original algorithm and reached a high accuracy.
- Finished the implementation of parallel computing on existing algorithms, which significantly reduced the time cost of a user feature pipeline.

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## ADDITIONAL INFORMATION

### Computer Skills

- **Languages:** MATLAB, Python, C/C++, L<sup>A</sup>T<sub>E</sub>X, Markdown
- **Tools:** Linux, Git, PyTorch, Anaconda

### English

- **GRE:** 162 (Verbal) + 169 (Quantitative)
- **TOEFL:** 30 (Reading) + 30 (Listening) + 26 (Speaking) + 28 (Writing)

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<sup>2</sup>Rani, B.-Y., Bar-Or, R. L., & Sompolsky, H. (1995) Theory of orientation tuning in visual cortex. *Proceedings of the National Academy of Sciences*, 92(9), 3844–3848.