Zhuo-Cheng Xiao, Ph.D.

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251 Mercer St, Rm 921, New York, NY 10012

Employment

2021 – 2023 **Courant Instructor/Postdoctoral Fellow,**

2020 – 2021 **Swartz Fellow,**
Courant Institute of Mathematical Sciences, New York University — New York, NY
Supervised by *Prof. Lai-Sang Young*.

Education

2016 – 2020 **Ph.D. in Applied Mathematics,** University of Arizona — Tucson, AZ
Co-Advised by *Prof. Kevin Lin* and *Prof. Jean-Marc Fellous*
Thesis - *Neuronal oscillations: In hippocampal functions and in simulations*

2012 – 2016 **Bachelor of Biological Sciences,**
Dual Degree of Mathematics, Peking University — Beijing, China
Advised by *Prof. Louis Tao*

Funding & Awards

Funding

Applying **Career Award at the Scientific Interface,** Burroughs Wellcome Fund.

2021 - 2023 **Courant Instructorship**, New York University.

2020-2021 **Swartz Fellowship**, Awarded by the Swartz Foundation.

Awards and Achievements

2020 **Travel Award**. SIAM Life Sciences.

2019 **Finalist of Michael Tabor's Graduate Scholarship**, University of Arizona.

Carter Award, University of Arizona.

2018-2019 **Don Wilson Travel Award**, University of Arizona.

2018 **Travel Award**, Computational Neuroscience Society.

2013-2016 **Undergraduate Research Honor Program**, Peking University.

2010 **Gold Medal (#5)**, Chinese Western Mathematical Olympiad.

Academic Services

Journal review:
PLoS One; NPJ Schizophrenia; Neural Computation; Cognitive Neurodynamics.

Research Interests

I combine modern data-driven methods and conventional ideas of model reductions to understand how brain functions emerge from complex dynamics of neuronal populations. I am also interested in mathematical questions arising from simulations and analysis of spiking networks.

Specific Research Items
- Efficient computational models of the visual cortex.
- Model reductions for coherent, oscillatory cortical dynamics.
- Reliability of numerical simulations of spiking networks.

Publication List

Manuscripts

1. Wu, T., Cai, Y., Zhang, R., Wang, Z., Tao, L., & **Xiao**, **Z.-C.** (2022). Multi-band oscillations emerge from a simple spiking network. *arXiv preprint arXiv:2206.14942 (Under review by Chaos)*.
2. **Xiao**, **Z.-C.**, & Lin, K. K. (2022a). Multilevel monte carlo for cortical circuit models. *Journal of Computational Neuroscience*, *50*(1), 9–15.
3. Zhang, R., Wang, Z., Wu, T., Cai, Y., Tao, L., **Xiao**, **Z.-C.**, & Li, Y. (2022). Learning biological neuronal networks with artificial neural networks: Neural oscillations. *arXiv preprint arXiv:2211.11169 (Submitted to Journal of Mathematical Biology)*.
4. Cai, Y., Wu, T., Tao, L., & **Xiao**, **Z.-C.** (2021). Model reduction captures stochastic gamma oscillations on low-dimensional manifolds. *Frontiers in Computational Neuroscience*, 74.
5. Dong, Y., Li, Y., Xiang, X., **Xiao**, **Z.-C.**, Hu, J., Li, Y., … Hailan, H. (2021). Stress relief as a natural resilience mechanism against depression. *Submitted to Neuron*.
6. **Xiao**, **Z.-C.**, Lin, K. K., & Young, L.-S. (2021). A data-informed mean-field approach to mapping of cortical parameter landscapes. *PLoS Computational Biology*, *17*(12), e1009718.
7. **Xiao**, **Z.-C.**, Lin, K., & Fellous, J.-M. (2020). Conjunctive reward–place coding properties of dorsal distal ca1 hippocampus cells. *Biological Cybernetics*, *114*(2), 285–301.
8. **Xiao**, **Z.-C.**, Wang, B., Sornborger, A. T., & Tao, L. (2018). Mutual information and information gating in synfire chains. *Entropy*, *20*(2), 102.
9. **Xiao**, **Z.-C.**, Zhang, J., Sornborger, A. T., & Tao, L. (2017). Cusps enable line attractors for neural computation. *Physical Review E*, *96*(5), 052308.
10. Wang, C., **Xiao**, **Z.-C.**, Wang, Z., Sornborger, A. T., & Tao, L. (2015). A fokker-planck approach to graded information propagation in pulse-gated feedforward neuronal networks. *arXiv preprint arXiv:1512.00520*.

Ongoing Work

1. **Xiao**, **Z.-C.**, & Lin, K. K. (2022b). Reliability of numerical simulations of spiking networks. In Preparation.
2. **Xiao**, **Z.-C.**, Lin, K. K., & Fellous, J.-M. (2022). The dynamics and reconsolidations of spatial representations of reward in brain. In Preparation.
3. **Xiao**, **Z.-C.**, Lin, K. K., & Young, L.-S. (2022). Efficient models of cortical activity via local dynamic equilibria and coarse-grained interactions. In Preparation.

Supervision Experience

Undergraduate Students

Zhuoran Li	2022-now	*Interdisciplinary Science major, PKU Class of 2023*
Zhongyi Wang	2021-now	*Mathematics major, PKU Class of 2023*
Ruilin Zhang	2020-now	*BS in Interdisciplinary Science PKU 2022.* Ruilin is now a PhD student at Peking University
Tianyi Wu	2020-2022	*BS in Mathematics PKU 2022.* Tianyi is now a PhD student at New York University
Athena Liu	2022	*BS in Mathematics NYU 2022.* Athena is now a master's student at New York University
Emily Bunnapradist	2022	*Mathematics major, Stanford U Class of 2023.*

Graduate Students

Jie Chang	2022-now	*PhD student in Life Sciences, PKU*
Yuhang Cai	2020-2022	*MS in Statistics U Chicago 2021.* Yuhang is now a PhD student at University of California, Berkeley.

Teaching

At New York University (as instructor)

2022 Fall	**Theory of Probability**
2022 Spring	**Ordinary Differential Equations**, (teaching evaluation: 4.7/5)
2021 Fall	**Discrete Mathematics**, (teaching evaluation: 4.1/5).

At University of Arizona

2018 Fall – 2020 Spring	**Principles and Methods of Applied Mathematics**, as teaching assistant
2018 Summer	Leader of the review sessions for applied math PhD qualification exam.
2017 Fall – 2018 Fall	**Ordinary Differential Equations**, as teaching assistant
2016 Fall – 2017 Spring	**College Algebra**, as instructor.

Invited Talks

2022.10	**Mathematical Neuroscience Seminar**, University of Nottingham Title: *Towards efficient cortical models retaining biological realism*	Nottingham, UK
	AMS Eastern Sectional Meeting Title: *A data-informed mean-field approach to mapping cortical landscapes*	Amherst, MA
2022.07	**SIAM Annual Meeting** Title: *A data-informed mean-field approach to mapping cortical landscapes*	Pittsburgh, PA
2022.02	**Courant Instructor Day**, New York University Title: *Efficient cortical modeling via local dynamic equilibria and coarse-grained interactions*	New York, NY
2021.06	**Society for Mathematical Biology** Title: *A data-informed mean-field approach to mapping cortical landscapes*	virtual
	A Bio Dynamics Days, LMAH-Le Havre Normandie & New York University Title: *A data-informed mean-field approach to mapping cortical landscapes*	virtual
2021.04	**Modeling and Simulation Group**, New York University Title: *Model reduction of gamma oscillations*	New York, NY
2019.03	**Analysis and Its Applications Seminar**, University of Arizona Title: *Computational strategies in analysis of hippocampal data*	Tucson, AZ
2018.02	**Modeling and Computation Seminar**, University of Arizona Title: *Multi-level Monte Carlo methods for spiking networks.*	Tucson, AZ