

Mengsen Zhang | Curriculum Vitae

Department of Computational Mathematics, Science and Engineering (CMSE)
Michigan State University – 428 South Shaw Ln, East Lansing, MI 48824

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“If there is a ‘secret of life’, it is here we must look for it, among the causes which bring about the arrangement of innumerable separate processes into a single harmonious living organism.”
— C. H. Waddington

Education

Florida Atlantic University <i>Ph.D. Complex Systems and Brain Sciences</i>	Florida, U.S. 2013–2018
University of Pennsylvania <i>M.S. Criminology</i>	Pennsylvania, U.S. 2011–2012
Peking University <i>B.S. Psychology & B.S. Pharmaceutical Sciences</i>	Beijing, China 2007–2011

Special Program.....

Santa Fe Institute <i>Complex Systems Summer School</i>	New Mexico, U.S. 2013
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Academic Positions

Michigan State University <i>Tenure-Track Assistant Professor</i> <i>Principal Investigator, Multiscale Complex Systems Lab</i>	Michigan, U.S. 2023–present
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Affiliations: Department of Computational Mathematics, Science and Engineering (CMSE, tenure home), Department of Medicine, Neuroscience Program

Areas: Multiscale modeling, Complex Systems, Neuroscience, Social interaction, Topological Data Analysis, Dynamical Systems, Psychiatry, Organization and Communication Sciences

University of North Carolina at Chapel Hill (UNC-CH) <i>Post-Doc Research Associate</i>	North Carolina, U.S. 2021–2023
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Advisor: Flavio Fröhlich, Ph.D.

Areas: Brain Stimulation, Ferrets, Social Interaction, Electrophysiology, Optogenetics, tACS, EEG, Schizophrenia, Depression, Dynamics.

Stanford University <i>Postdoctoral Scholar</i>	California, U.S. 2019–2021
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Advisor: Manish Saggar, Ph.D.

Areas: Topological Data Analysis, Dynamical Systems, Brain network models, Neuroimaging.

Florida Atlantic University <i>Graduate Research Assistant</i>	Florida, U.S. 2013–2018
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Advisors: Emmanuelle Tognoli, Ph.D. & J. A. Scott Kelso, Ph.D.

Committee Members: Christopher Beetle, Ph.D., Armin Fuchs, Ph.D.

Dissertation Title: The Coordination Dynamics of Multiple Agents (**Zhang**, 2018)

Areas: Nonlinear Dynamics, Coordination Dynamics, Social interaction, Topological Data Analysis, EEG.

Research Support

Submitted.....

NIH R21 – Longitudinal neurodynamics effects of meditation **Michigan State University**
Role: co-Investigator, Direct Cost: \$275,000 (USD) *(Pending Review) 2025-2027*
Title: “Understanding Neural Processes Underlying Mantra-Based Meditation and their Longitudinal Changes”
PI: Saiprasad Ravishankar, Ph.D.
Program: Fundamental Science Research on Complementary and Integrative Health Approaches

Incoming.....

NIH R34 (MPIs) – Multiscale modeling of social interaction **Michigan State University**
Role: lead PI, Direct Cost: \$450,000 (USD); Total Cost: \$663,000 (USD) *(Pending Award) 2024-2026*
Title: “Mapping dynamic transitions across neural, behavioral, and social scales in interacting animals”
co-PI: Flavio Fröhlich, Ph.D., UNC-CH
Program: BRAIN Initiative: Brain-Behavior Quantification and Synchronization – Transformative and Integrative Models of Behavior at the Organismal Level

Ongoing.....

Foundation of Hope – Interbrain synchronization in psychotherapy **UNC-CH**
Role: Lead PI, Direct Cost: \$41,080 *2022-2025*
Title: “Network Neuroscience of a Novel Brief Intervention for Stress and Depression Symptoms in College Students”
co-PI: Tobias Schwippel, M.D.

Completed.....

Helen Lyng White Postdoctoral Fellowship **UNC-CH**
Role: PI, Direct Cost: \$25,000 *2022-2023*
Title: “Multiscale mechanisms of interbrain synchronization in humans and animals”

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For publication and presentation lists below: † co-first author; ◊ co-last author; * mentee

Publications

- Luo[†], X., & Zhang[†], M. (*To be submitted*). Beyond the blind men and the elephant: Capturing the multi-scale, multi-facet changes in psychotherapy using topological analyses.
- Guirguis, V., Korsapathy, S., Pupillo, F., McClure, R., Zarzar, D., Zhang, M., ... Schwippel[◊], T. (*To be submitted*). Esketamine disinhibits brain networks in depression: Evidence from oscillatory and aperiodic activity.
- McKinley, J., Zhang, M., Brumley, A. W., Williams, C., Tognoli, E., & Beetle, C. (*To be submitted*). Continuous third-party entrainment in generalized systems of coupled multistable oscillators.
- Ross*, G., Huang, A. W., Reiling*, J., Zhang, M., Park, J., Radtke-Schuller, S., ... Fröhlich, F. (*To be submitted*). Frontoparietal oscillatory activity is influenced by attentional load in the ferret.
- Zhang, M., & Kelso, J. A. S. (*Under revision*). Elements of Coordination Dynamics in social sciences. In Y. Shapiro & E. Mitleton-Kelly (Eds.), *Elgar Encyclopedia of Complexity in the Social Sciences*. Edward Elgar Publishing.

- Hancock, F., Rosas, F. E., Luppi, A., **Zhang, M.**, Mediano, P. A. M., Cabral, J., ... Turkheimer, F. E. (*Under revision*). Metastability demystified — the foundational past, the pragmatic present, and the promising future. *Nature Review Neuroscience*. doi: 10.20944/preprints202307.1445.v1
- Zhang**[†], **M.**, Chowdhury[†], S., & Saggari, M. (2023). Temporal Mapper: transition networks in simulated and real neural dynamics. *Network Neuroscience*, 7(2), 431-460. doi: 10.1101/2022.07.28.501877
- Sun, Y., **Zhang, M.**, & Saggari, M. (2023). Cross-attractor modeling of resting-state functional connectivity in psychiatric disorders. *NeuroImage*, 279, 120302. doi: <https://doi.org/10.1016/j.neuroimage.2023.120302>
- Sidelinger^{†*}, L., **Zhang**[†], **M.**, Fröhlich[◇], F., & Daughters[◇], S. (2023). Day-to-day individual alpha frequency stability measured by a mobile EEG device relates to anxiety and inhibition. *European Journal of Neuroscience*, 57(11), 1815-1833. doi: <https://doi.org/10.1111/ejn.16002>
- McKinley, J., **Zhang, M.**, Wead, A., Williams, C., Tognoli, E., & Beetle, C. (2023). Restoring coordination to systems of nonidentical oscillators through third party pacing. *AIP Conference Proceedings*, 2872(1), 120042. doi: 10.1063/5.0164525
- Zhang, M.**, Force, R. B., Walker, C., Ahn, S., Jarskog, L. F., & Fröhlich, F. (2022). Alpha transcranial alternating current stimulation reduces depressive symptoms in people with schizophrenia and auditory hallucinations: a double-blind, randomized clinical trial. *Schizophrenia*, 8(1), 114. doi: 10.1038/s41537-022-00321-0
- Zhang, M.**, Sun, Y., & Saggari, M. (2022). Cross-attractor repertoire provides new perspective on structure-function relationship in the brain. *NeuroImage*, 259, 119401. doi: 10.1016/j.neuroimage.2022.119401
- Zhang, M.**, Riddle, J., & Fröhlich, F. (2022). Closed-loop control of bistable symptom states. *Brain Stimulation*, 15(2), 454-456. doi: 10.1016/j.brs.2022.02.010
- Zhang, M.**, & Fröhlich, F. (2022). Cell type-specific excitability probed by optogenetic stimulation depends on the phase of the alpha oscillation. *Brain Stimulation*, 15(2), 472-482. doi: 10.1016/j.brs.2022.02.014
- McKinley, J., **Zhang, M.**, Wead, A., Williams, C., Tognoli, E., & Beetle, C. (2021). Third party stabilization of unstable coordination in systems of coupled oscillators. *Journal of Physics: Conference Series*, 2090(1), 012167. doi: 10.1088/1742-6596/2090/1/012167
- Tognoli, E., **Zhang, M.**, Fuchs, A., Beetle, C., & Kelso, J. A. S. (2020). Coordination dynamics: A foundation for understanding social behavior. *Frontiers in Human Neuroscience*, 14, 317. doi: 10.3389/fnhum.2020.00317
- Zhang, M.**, Kalies, W. D., Kelso, J. A. S., & Tognoli, E. (2020). Topological portraits of multiscale coordination dynamics. *Journal of Neuroscience Methods*, 339. doi: 10.1016/j.jneumeth.2020.108672
- Zhang, M.**, Beetle, C., Kelso, J. A. S., & Tognoli, E. (2019). Connecting empirical phenomena and theoretical models of biological coordination across scales. *Journal of The Royal Society Interface*, 16(157), 20190360. doi: 10.1098/rsif.2019.0360
- Zhang, M.** (2018). *The Coordination Dynamics of Multiple Agents* (Doctoral Dissertation, Florida Atlantic University). Retrieved from https://mengsenz.github.io/docs/Zhang_2018FAU_MultiagentCoordination.pdf
- Zhang, M.**, Kelso, J. A. S., & Tognoli, E. (2018). Critical diversity: Divided or united states of social coordination. *PLOS ONE*, 13(4), e0193843. doi: 10.1371/journal.pone.0193843

- Tognoli, E., **Zhang, M.**, & Kelso, J. A. S. (2018). On the nature of coordination in nature. In J. M. Delgado-García, X. Pan, R. Sánchez-Campusano, & R. Wang (Eds.), *Advances in Cognitive Neurodynamics (VI)* (pp. 375–382). Singapore: Springer. doi: 10.1007/978-981-10-8854-4_48
- Dumas, G., Lefebvre, A., **Zhang, M.**, Tognoli, E., & Kelso, J. A. S. (2018). The Human Dynamic Clamp: A probe for coordination across neural, behavioral, and social scales. In S. C. Müller, P. J. Plath, G. Radons, & A. Fuchs (Eds.), *Complexity and Synergetics* (pp. 317–332). Cham: Springer International Publishing. doi: 10.1007/978-3-319-64334-2_24
- Zhang, M.**, Dumas, G., Kelso, J. A. S., & Tognoli, E. (2016). Enhanced emotional responses during social coordination with a virtual partner. *International Journal of Psychophysiology*, 104, 33 - 43. doi: 10.1016/j.ijpsycho.2016.04.001
- Zhang, M.**, Nordham, C., & Kelso, J. A. S. (2015). Deterministic versus probabilistic causality in the brain: To cut or not to cut. *Physics of Life Reviews*, 15, 136 - 138. doi: <https://doi.org/10.1016/j.plprev.2015.10.002>

In Preparation

- Modolo, J., Duprez, J., Legros, A., **Zhang, M.**, & Fröhlich, F. (*In prep*). Mechanisms and controversies of transcranial current stimulation.
- Zhang**[†], M., Campbell[†], A. M., Fröhlich, F., & Rubinow, D. (*In prep*). Dynamic neural mechanisms of brexanolone-induced antidepressant effects in postpartum depression.
- Zhang, M.**, Patel, D., Radtke-Schuller, S., & Fröhlich, F. (*In prep*). Alpha and theta oscillations mediate directed interbrain synchronization in socially interacting ferrets.
- Burns[†], T., & **Zhang**[†], M. (*In prep*). The role of state-space geometry in correlated dense associative memory models.
- Schwippel, T., Pupillo, F., LaGarde, H., **Zhang, M.**, Rubinow, D., & Fröhlich, F. (*In prep*). Clinical and neurophysiological effects of alpha transcranial alternating current stimulation for the treatment of depression: A randomized, controlled clinical trial.

Invited Talks

- Zhang, M.** (2024, November 7). *Topological characterization of a shifting dynamic landscape in biosocial sciences.* (Topological Data Analysis Seminar, Michigan State University)
- Zhang, M.** (2024, November 1). *The shape of complex behavioral-brain dynamics.* (Cognitive Science Colloquium Series, Department of Psychology, Michigan State University)
- Zhang, M.** (2024, September 17). *Dynamical systems as connecting threads from cellular to social interactions.* (Integrative Biology Seminar, Michigan State University)
- Zhang, M.** (2024, August 18). *Multistability and transitions the connecting thread across neural-social systems.* (Biological Physics and Physical Biology (BPPB) Seminar, Virtual only | [link to recording](#))
- Zhang, M.** (2024, May 15). *The coordination dynamics of multiagent social interaction.* (Dynamic Models in Social Sciences, Kalamazoo College)
- Zhang, M.** (2024, May 15). *Dynamical systems approach to brain and social complexity.* (Introduction to Cognitive Science, Kalamazoo College)

- Zhang, M.** (2024, April 16). *The bumpy landscape of brain and social coordination dynamics*. (Special Neuroscience Seminar: In Memory of Dr. Emmanuelle Tognoli, Florida Atlantic University)
- Zhang, M.** (2024, April 10). *Mapping brain and behavioral transitions in a global landscape*. (Keynote Speaker, Criticality, Networks and Neuroscience Workshop, Centro Internacional de Ciencia A.C., Mexico)
- Zhang, M.** (2023, October 6). *States and transitions: charting the complex landscape of neural and social dynamics*. (Computational Mathematics, Science and Engineering Seminar, Michigan State University)
- Zhang, M.** (2023, March 17). *Temporal Mapper: When dynamical systems meet data-driven modeling*. (Precision Psychiatry & Social Physiology Seminar, University of Montreal, Canada)
- Zhang, M.** (2023, January 13). *Unmasking multistable dynamics in movement, brain activity, and stimulation*. (Center for Cognitive Neuroscience Colloquium, Duke University)
- Zhang, M.** (2022, May 21). *Computational characterization of large-scale brain dynamic landscapes and attractor transition networks*. (The fourth Data-Driven Science and AI Conference, Florida Atlantic University)
- Zhang, M.** (2022, April 18). *Probing phase-dependent neuronal excitability and controlling bistable symptom states using invasive brain stimulation*. (Cagnan Group, University of Oxford)
- Zhang, M., Riddle, J., & Fröhlich, F.** (2022, March 3). *Multistability and nonlinearity in symptom dynamics and symptom-brain relations*. (Weill Neurohub, University of California San Francisco)
- Zhang, M.** (2021, July 7). *Transitions and their topological signatures in social and brain dynamics*. (Topological Data Analysis Seminar, Michigan State University)
- Zhang, M.** (2021, May 28). *Flexible coordination and system complexity in social and brain dynamics*. (TCCI NeuroChat, Tianqiao and Chrissy Chen Institute)
- Zhang, M.** (2021, March 26). *Dynamics meet networks: how diverse nodes and links impact functional complexity*. (Brain Networks and Behavior Lab, the Department of Psychological and Brain Sciences at Indiana University, Bloomington)
- Zhang, M.** (2020, November 18-20). *Always on the move: Fluid social coordination across scales*. (Social BRIDGES e-conference | [link to recording](#))
- Zhang, M.** (2020, June 18). *Social coordination across spatiotemporal scales*. (Virtual NeuroSymposium, Montreal, Québec, Canada | [link to recording](#))
- Zhang, M., Kalies, W. D., Kelso, J. A. S., & Tognoli, E.** (2020, June 8). *Topological portraits of multiscale coordination dynamics*. (Minisymposium: Applications and Methods in Topological Data Analysis and Machine Learning, SIAM Conference on Mathematics of Data Science, Virtual | [link to recording](#))
- Zhang, M., Kalies, W. D., Kelso, J. A. S., & Tognoli, E.** (2020, March 30). *Topological portraits of multiscale coordination dynamics*. (the Neuromatch Conference | [link to recording](#))
- Zhang, M.** (2019, May 14). *The Coordination Dynamics of Multiple Agents*. (Stanford Complexity Group, Stanford, California, CA | [link to recording](#))
- Zhang, M.** (2017, October 19). *Identifying pattern changes in human rhythmic movement coordination with persistent homology*. (Analysis and Applications Seminar, Department of Mathematics, Florida Atlantic University, FL)
- Zhang, M.** (2016, September 14). *Multiagent social coordination dynamics*. (Department of Psychology, University of Miami, FL)

Selected Conference Presentations

- Zhang, L., **Zhang, M.**, & Pentland, B. (2024, October 25). *Topological analysis reveals organizational routines recurrence in outpatient medical clinics during COVID-19*. (Poster, SIAM Conference on Mathematics of Data Science, Atlanta, Georgia, U.S.)
- Li, A., Pradhan, P., Ika, K., **Zhang, M.**, Cohen, B. H., & Ravishankar, S. (2024, October 9). *Understanding longitudinal effects of mantra meditation and breath-focused meditation using EEG*. (Poster, Society for Neuroscience Annual Conference, Chicago, USA)
- Reiling*, J., Fröhlich, F., & **Zhang, M.** (2024, October 7). *Topological data analysis characterizes rich behavioral dynamics in naturalistic social interaction in ferrets*. (Poster, Society for Neuroscience Annual Conference, Chicago, USA)
- Schwippel, T., Pupillo, F., LaGarde, H., **Zhang, M.**, Rubinow, D., & Fröhlich, F. (2024, May 9-11). *Mapping temporal brain network dynamics during a 10 Hz tACS treatment for depression*. (Poster, Society of Biological Psychiatry Annual Conference, Austin, Texas)
- Reiling*, J., & **Zhang, M.** (2024, March 8). *Improving accuracy of multi-animal motion tracking by supplementing deep learning with body model-based automatic corrections*. (Best Poster Award, Engineering Graduate Research Symposium, Michigan State University)
- McKinley, J., **Zhang, M.**, Wead, A., Williams, C., Tognoli, E., & Beetle, C. (2024, March 3-8). *Dynamic third-party entrainment and learning in systems of multistable oscillators*. (Talk, American Physical Society Meeting, Minneapolis, MN)
- Zhang, M.**, Patel, D., Radtke-Schuller, S., & Fröhlich, F. (2023, November 11-15). *Alpha oscillations mediate directed interbrain synchronization in socially interacting ferrets*. (Poster, Society for Neuroscience Annual Conference, Washington DC)
- Luo, X., & **Zhang, M.** (2023, June 21-24). *Can topological methods capture high-dimensional transitions during alliance ruptures in psychotherapy?* (Poster, the 54th Annual International Meeting of the Society for Psychotherapy Research, Dublin)
- Zhang, M.**, Force, R. B., Walker, C., Ahn, S., Jarskog, L. F., & Fröhlich, F. (2022, November 12-16). *Frontotemporal alpha-frequency transcranial alternating current stimulation (tACS) reduces depressive symptoms in people with schizophrenia and auditory hallucinations in a double-blind placebo-controlled clinical trial*. (Poster, Society for Neuroscience Annual Conference, San Diego, CA)
- Zhang, M.**, Chowdhury, S., & Saggari, M. (2022, September 30). *Temporal Mapper: A Mapper-inspired approach to analyzing nonlinear brain dynamics*. (Talk, SIAM Conference on Mathematics of Data Science, San Diego, CA)
- Sun, Y., **Zhang, M.**, & Saggari, M. (2022, April 28-30). *Biophysical modeling of resting-state functional connectivity reveals insights into symptoms of psychopathology*. (Poster, Society of Biological Psychiatry Annual Meeting, New Orleans, LA)
- McKinley, J., **Zhang, M.**, Wead, A., Williams, C., Tognoli, E., & Beetle, C. (2021, September 6). *Third party stabilization of unstable coordination in systems of coupled oscillators*. (Talk, The 10th International Conference on Mathematical Modeling Physical Sciences, Online, Greece)
- Zhang, M.**, & Saggari, M. (2020, October 26-30). *Intrinsic dynamic landscape of the brain shaped by multiscale structural constraints*. (Talk, the Neuromatch Conference 3.0 | [link to recording](#))
- Zhang, M.**, & Saggari, M. (2020, October 6-8). *Complexity of intrinsic brain dynamics shaped by multiscale*

structural constraints. (Poster, the Brain Criticality Virtual Meeting | [link to poster](#))

Zhang, M., Chowdhury, S., & Saggar, M. (2019, October 21). *The topology of time: Characterizing transitions in simulated neural dynamics using topological data analysis.* (Poster, Society for Neuroscience Annual Meeting, Chicago, IL)

Stefanescu, R. A., **Zhang, M.**, Fuchs, A., Steinberg, F. L., Tognoli, E., & Kelso, J. A. S. (2018, November 7). *Transaction of agency between self and other: an fMRI study of social coordination.* (Poster, Society for Neuroscience Annual Meeting, San Diego, CA)

Zhang, M., Beetle, C., Kelso, J. A. S., & Tognoli, E. (2018, July 25). *Linking the many and the few: an experimental-theoretical analysis of multiagent coordination.* (Oral presentation, the Ninth International Conference on Complex Systems, Cambridge, MA)

Kelso, J. A. S., **Zhang, M.**, & Tognoli, E. (2018, May 1–4). *Coordination laws for couples and collectives: What about the 'in-between'?* (Society of Experimental Psychologists Annual Meeting, Tucson, Arizona)

Mediano, P. A. M., Rosas, F., & **Zhang, M.** (2018, March 20). *Synergistic synchronisation in coupled oscillators.* (Poster, Conference on Analysis and Modeling of Complex Oscillatory Systems, Barcelona, Spain)

Zhang, M., Kelso, J. A. S., & Tognoli, E. (2017, November 12). *Multiagent social coordination dynamics – from experiment to model.* (Poster, Society for Neuroscience Annual Meeting, Washington, D.C.)

Zhang, M., Kelso, J. A. S., & Tognoli, E. (2017, September 18). *Multiagent coordination dynamics: the Human Firefly Experiment.* (Oral presentation, Conference on Complex Systems, Cancun, Mexico)

Zhang, M., Kelso, J. A. S., & Tognoli, E. (2017, July 22). *A new paradigm for studying pattern generation in multiagent systems.* (Poster, Progress in Motor Control XI, Miami, Florida)

Zhang, M., Dumas, G., Tognoli, E., & Kelso, J. A. S. (2016, November 14). *How social coordination emerges and changes among multiple heterogeneous agents: An experimental 'human firefly' study.* (Poster, Society for Neuroscience Annual Meeting, San Diego, CA)

Zhang, M., Dumas, G., Tognoli, E., & Kelso, J. A. S. (2014, November 16). *Emotional response during human-Virtual Partner interaction.* (Poster, Society for Neuroscience Annual Meeting, Washington, D.C.)

Zhang, M. (2012, November 15). *Agent-Based Modeling and its potential use in developing criminology theories with interdisciplinary evidence.* (Oral presentation, the 64th Annual Meeting of the American Society of Criminology, Chicago, Illinois)

Zhang, M., & Raine, A. (2011, November 17). *Psychopathic personality enhances proactive aggression in east asian females but not males.* (Poster, the 63rd Annual Meeting of the American Society of Criminology, Washington, D.C.)

Raine, A., **Zhang, M.**, Appelby, S., & Venables, P. H. (2011, May 20). *Early childhood risk factors for psychopathic personality in adulthood: Findings from the mauritius child health project.* (Oral presentation, 4th biennial meeting of the Society for the Scientific Study of Psychopathy, Montreal, Canada)

Teaching

Michigan State University

Assistant Professor

CMSE 201 – Computational Modeling and Data Analysis

CMSE 381 – Fundamentals of Data Science Methods

Michigan U.S.

2023-present

NVIDIA Deep Learning Institute (DLI) **California, U.S.**
Certified Instructor & University Ambassador 2019–present
Teach workshops on “the Fundamentals of Accelerated Computing with CUDA C/C++” at Stanford University (hosted by Stanford Research Computing Center).

Stanford University, Brain Dynamics Lab **California, U.S.**
Instructor 2019–2020
Teach a running series of tutorials on Nonlinear Dynamics to members of the lab.

Florida Atlantic University, College of Science **Florida, U.S.**
Instructor 2016
Gave a series of lectures in the “Matlab Boot Camp” on the basics of programming, MATLAB and signal processing, for students in the College of Science.

Florida Atlantic University **Florida, U.S.**
Teaching Assistant 2013–2018
Taught undergraduate courses “Psychology”, “Biological Bases of Behavior”, and “Comparative Animal Behavior”.

Honors and Awards

- **Helen Lyng White Fellowship**, University of North Carolina at Chapel Hill 2022
- **Brain Institute Travel Award**, Florida Atlantic University. 2016
- **NSF Travel Award**, Society for Social Neuroscience. (ID: 1543122; PI: Dr. Stephanie Cacioppo). 2016
- **Graduate Fellowship of Academic Excellence**, Florida Atlantic University. 2014
- **1-st Year Graduate Research Award**, College of Science, Florida Atlantic University. 2014

Professional Membership

- Society for Industrial and Applied Mathematics (SIAM) 2017–Present
- Society for Neuroscience (SfN) 2014–Present
- American Society of Criminology (ASC) 2011–2013

Scientific and Professional Service

Conference Organization and Facilitation.....

Symposium at Society of Biological Psychiatry Annual Conference **Toronto, Canada**
Symposium Chair 2025

Symposium title: “Treatment induced dynamic state transitions in brain and behavior”
Co-chair: Flavio Fröhlich, University of North Carolina at Chapel Hill

Panel at Society for Psychotherapy Research Annual Conference **University of Ottawa, Canada**
Panel discussant 2024

Panel title: “Capturing the dynamic and complex microprocesses in psychotherapy”
Chair & Organizer: Xiaochen Luo. Santa Clara University

Reviewer Responsibility.....

Collaborative Research in Computational Neuroscience program (CRCNS) NSF-lead, Multinational
Panel grant reviewer 2023

CRCNS is a joint activity of the US National Science Foundation (NSF), National Institutes of Health (NIH), and Department of Energy (DOE); Germany’s Federal Ministry for Education and Research (BMBF), the French National Research Agency (ANR), the US-Israel Binational Science Foundation (BSF), Japan’s National Institute of Information and Communications Technology (NICT), and Spain’s State Research Agency (Agencia Estatal de Investigación, AEI)

Perception, Action, and Cognition program **National Science Foundation**
Ad-hoc grant reviewer 2019–present

Practice & Experience in Advanced Research Computing (PEARC) Conference 2011
Reviewer for conference papers

Reviewer for peer-reviewed journals:

Brain Stimulation, European Journal of Neuroscience, PLOS Computational Biology, Human Movement Science, Network Neuroscience, Frontiers in Computational Biology, Frontiers in Psychology, Scientific Reports, Cognitive Processing, Cognitive Systems Research, Biological Cybernetics, International Journal of Psychophysiology, PLoS ONE, Physics of Life Reviews, Psychological Science, Journal of Neuroscience Research.

Society Services.....

Society for Industrial and Applied Mathematics – Student Chapter Florida Atlantic University
Vice President 2018-2019

Society for Industrial and Applied Mathematics – Student Chapter Florida Atlantic University
Secretary 2017-2018

Internal Services.....

CMSE Computational Biology Cluster Hire Search Committee Michigan State University
Committee Member 2024-present

Graduate Student Dissertation Committees Michigan State University
Committee Member 2023-present

Students: David Munoz Ramirez (CMSE Ph.D. program), Faith Houck (Kinesiology Ph.D. program), Sunia Tanweer (Mechanical Engineering Ph.D. program), Rachel Roca (CMSE Ph.D. program), Maxwell Chumley (Mechanical Engineering & CMSE dual Ph.D. program).

CMSE Graduate Student Admission Committee Michigan State University
Committee Member 2023-2024

Department of Medicine Cluster Hire Search Committee Michigan State University
Committee Member 2023-2024

Mentoring Experience

Below is a selected list of students that I have mentored:

- o Patience Akatuhwera (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) 2024-present
Topological data analysis of brain and social dynamics.
- o Atoshi Das (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) 2024-present
Dynamical landscape analysis of brain dynamics.
- o Jared Reiling (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) 2023-present
Multiscale computational modeling of animal behavior, deep learning.
- o Grace Ross (Ph.D. student, Neuroscience, UNC-CH) 2021–2024
Electrophysiology time series analyses to study posterior visual network dynamics during visual perception in ferrets.
- o Dhruvi Patel (undergraduate student, Biology, UNC-CH) 2022–2023
Ferret behavior and electrophysiology data collection and analysis.
- o Lauren Sidelinger (undergraduate student, Neuroscience/Computer Science, UNC-CH) 2021–2023
EEG time series analyses to study the long-term stability of resting brain dynamics.
- o Preetam Tanikella (undergraduate student, Biostatistics, UNC-CH) 2021–2022
Electrical and mechanical engineering for animal behavior training box.
- o Noah Trexler (undergraduate student, Computer Science, UNC-CH) 2021–2022
Electrical and software engineering for animal behavior training box.

- Mary Enloe (undergraduate student, Computer Science, UNC-CH) 2021
Mechanical engineering for animal behavior training box.
- Rafi Ayub (graduate student, Bio-engineering, Stanford University) 2019–2020
Biophysical network modeling of brain dynamics, assisting Dr. Manish Saggar.
- Joshua Child (graduate student, Political Sciences, Florida Atlantic University) 2018
Directed Independent Study on oscillator models of economic inequality.
- Nadine Akin (postgraduate student, Biological Sciences, Florida Atlantic University) 2017-2018
Analysis of dynamical behavioral data from a social coordination experiment.
- Ananda Chowdhury (undergraduate student, Engineering, Florida Atlantic University) 2015-2016
Signal processing, and analysis of multiagent interaction data.
- Daniela Herrera (undergraduate student, Neuroscience, Florida Atlantic University) 2015-2016
Behavioral data acquisition for multiagent coordination experiments.

Outreach

- In 2022, I collaborated with the Community for Rigor ([c4r](#)). C4R is an open resource platform to help researchers of all kinds learn, practice, and promote scientific rigor. I worked with Kevin Rusch to perform interviews and design podcasts on the topic of scientific rigor.
- Since 2020, I maintain a twitter list to promote Women in Computational Neuroscience ([link](#)).
- In 2020, I volunteered for Neuromatch 3.0 ([link](#)) as a emcee for five sessions of talks. Neuromatch 3.0 is an online unconference aiming to make neuroscience conferences more open, inclusive, and democratic.
- In 2020, I volunteered for the Neuromatch Academy ([link](#)) to help prepare lecture materials. The Neuromatch Academy is a nonprofit online school to make computational neuroscience more inclusive and diverse.
- In 2019, I joined a nonprofit organization, Women of AI ([link to website](#)), to make programming training more accessible to women interested in data science. I coordinate activities between the organization, Stanford Research Computing Center, and NVIDIA Corporation.
- In 2016, I wrote a popular science article to explain human-machine coordination to Chinese readers, entitled “Human-human coordination vs. human-machine coordination: Does it feel the same?” (in Chinese, [link to article](#))

Computational Techniques

- **Parallel Computing:** CUDA C/C++ for accelerated solutions using NVIDIA GPUs, frequently used with MATLAB mex-function for easy interface. Since 2014, I have employed CUDA-based parallel computing techniques for various applications, including digital signal processing (Wavelet transform, $\sim 100\times$ acceleration), simulation and parameter exploration of differential equations ($\sim 1000\times$ acceleration, Zhang, Beetle, Kelso, and Tognoli 2019), and graph matching ($\sim 150\times$ acceleration, Zhang[†], Chowdhury[†], and Saggar 2023). Specific acceleration factors depend on the intrinsic parallelizability of the problem.
- **Open- & Closed-Loop Data Acquisition:** I have engineered complex experimental apparatuses and software for real-time and/or closed-loop recording and modulation (e.g. Zhang, Kelso, & Tognoli, 2018). My work relies on innovative experimental paradigms, for which proprietary hardware often lacks flexibility or lead to unacceptable latency. To build satisfactory experimental equipment, I developed a system of techniques utilizing open hardware, involving sensor engineering, printed circuit board design, micro-controller programming, and software engineering.
- **Applied Mathematics & Numerical Methods:** My work is tightly connected to the mathematics of Nonlinear Dynamics, Topology, Geometry, and associated numeric methods. By training and by practice,

I have developed expertise in ordinary differential equations (Zhang et al., 2019; Zhang, Dumas, Kelso, & Tognoli, 2016), partial differential equations (in particular, weak solutions of pattern formation problems with irregular or moving boundaries, using finite element method), stochastic differential equations (Zhang[†] et al., 2023; Zhang, Sun, & Saggarr, 2022), algebraic topology (Zhang, Kalies, Kelso, & Tognoli, 2020), and computational geometry (Zhang[†] et al., 2023).

Other Activities and Achievements

- **Actor/Singer** 2012
In the short musical "The Last Mummer", directed by Wally Zialcita, Philadelphia, PA
- **Internship** 2010-2011
Phase III Clinical Trial Laboratory, Pharmacy Department, Peking University Third Hospital, Beijing, China
- **Director of University Radio Station** 2008-2009
Peking University Health Science Center, Beijing, China
- **Co-founder and Co-director of Student Association of Psychology** 2007-2008
Peking University Health Science Center, Beijing, China
- **Professional Renju Player** 2005-2006
National Champion (2x; China), World Third (1x)
- **The Best Poet Award** 2005
The First Chinese Student Poetry Festival, Sichuan, China
Three award-winning poems were later published in an anthology "Soaring Youth" (2008, People's Literature Publishing House, China)