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 — **Florida, U.S.**
Ph.D. Complex Systems and Brain Sciences — *2013–2018*

University of Pennsylvania — **Pennsylvania, U.S.**
M.S. Criminology — *2011–2012*

Peking University — **Beijing, China**
B.S. Psychology & B.S. Pharmaceutical Sciences — *2007–2011*

Special Program

Santa Fe Institute — **New Mexico, U.S.**
Complex Systems Summer School — *2013*

Academic Positions

Michigan State University — **Michigan, U.S.**
Tenure-Track Assistant Professor — *2023–present*

Principal Investigator, Multiscale Complex Systems Lab

Affliations: Department of Computational Mathematics, Science and Engineering (CMSE, tenure home), Department of Medicine, Neuroscience Program, Ecology, Evolution, and Behavior Program (EEB)

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) — **North Carolina, U.S.**
Post-Doc Research Associate — *2021–2023*

Advisor: Flavio Fröhlich, Ph.D.

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

Stanford University — **California, U.S.**
Postdoctoral Scholar — *2019–2021*

Advisor: Manish Saggar, Ph.D.

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

Florida Atlantic University — **Florida, U.S.**
Graduate Research Assistant — *2013–2018*

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

Current

NIH R34DA061924 – Multiscale modeling of social interaction **Michigan State University**
Role: lead PI, Budget: $666,380 (USD) *2025-2027*
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

Completed

Foundation of Hope – Interbrain synchronization in psychotherapy **UNC-CH**
Role: Lead PI, Budget: $41,080 *2022-2026*
Title: "Network Neuroscience of a Novel Brief Intervention for Stress and Depression Symptoms in College Students"
co-PI: Tobias Schwippel, M.D.

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 before/under peer-review

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.

Zhang, **M**., Campbell, A., Kozik, R., Riddle, J., Fröhlich, F., & Rubinow, D. (*Under review*). Neural attractor dynamics anticipate affective state change in postpartum depression during brexanolone treatment.

Stein, A., Schwippel, T., Pupillo, F., LaGarde, H., **Zhang**, **M**., Rubinow, D., & Fröhlich, F. (2026). Daily eeg reveals stage-specific alpha power and functional connectivity modulation across five days of tacs in major depressive disorder. *medRxiv*, 2026.03. 17.26348546.

Schwippel, T., Pupillo, F., LaGarde, H., Stein, A., **Zhang**, **M**., Rubinow, D., & Fröhlich, F. (2026). Suppression of endogenous alpha power predicts clinical response to 10 hz tacs in major depressive disorder: A double-blind randomized controlled trial. *medRxiv*, 2026.03. 17.26348625.

Pentland, B. T., Zhang, L., **Zhang**, **M**., Wolf, J. R., & Pentland, A. P. (*Under revision*). Exploring patterns of recurrence in organizational routines with topological data analysis.

Ross, G., Huang, W. A., **Zhang**, **M**., Radtke-Schuller, S., Hopfinger, J., & Fröhlich, F. (*In revision*). Increased sustained attention and neuronal entrainment by rhythmic optogenetic stimulation of the dorsal fronto-parietal network.

Park, J., Ross, G., Siekierski, P., **Zhang**, **M**., Radtke-Schuller, S., Zuberer, A., & Fröhlich, F. (*Under review*). Optogenetic stimulation reveals frequency tuned communication between the claustrum and premotor cortex in ferrets.

Modolo[†], J., **Zhang**[†], **M**., Duprez, J., & Fröhlich, F. (2024). Mechanisms and controversies of transcranial current stimulation. *arXiv; Under review*. doi: https://doi.org/10.48550/arXiv.2410.05841

Peer-reviewed Publications

Zhang, **M**., & Kelso, J. A. S. (*In Press*). 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.

Stein, A., Floegel, E., **Zhang**, **M**., Subramaniyan, A., Sharma, S., Feldman, Z., … Fröhlich, F. (2026). Establishing naturalistic brain stimulation targeting aperiodic eeg features: Transcranial endogenous current stimulation (tECS). *Brain Stimulation*, *19*(2), 103036.

Luo[†], X., & **Zhang**[†], **M**. (2026). A topological data analysis method for revealing dynamic changes in psychotherapy microprocesses. *Frontiers in Psychology*, *16*. doi: https://doi.org/10.3389/fpsyg.2025.1711782

Gerber, S. M., Riddle, J., Lagarde, H., **Zhang**, **M**., & Fröhlich, F. (2025). Intuitive virtual reality based frontal-midline theta neurofeedback: a feasibility study in young ages. *Frontiers in Virtual Reality*, *Volume 6 - 2025*. doi: 10.3389/frvir.2025.1499413

Guirguis, V., Korsapathy, S., Pupillo, F., McClure, R., Zarzar, D., **Zhang**, **M**., … Schwippel[◇], T. (2025). Esketamine disinhibits brain networks in depression: Evidence from oscillatory and aperiodic activity. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *140*, 111438. doi: https://doi.org/10.1016/j.pnpbp.2025.111438

Ross*, G., Huang, A. W., Reiling*, J., **Zhang**, **M**., Park, J., Radtke-Schuller, S., … Fröhlich, F. (2025). Switching state to engage and sustain attention: Dynamic synchronization of the frontoparietal network. *Progress in Neurobiology*, *250*, 102777. doi: https://doi.org/10.1016/j.pneurobio.2025.102777

Hancock, F., Rosas, F. E., Luppi, A., **Zhang**, **M**., Mediano, P. A. M., Cabral, J., … Turkheimer, F. E. (2025). Metastability demystified — the foundational past, the pragmatic present, and the promising future. *Nature Review Neuroscience*, *26*, 82-100. doi: https://doi.org/10.1038/s41583-024-00883-1

Zhang[†], **M**., Chowdhury[†], S., & Saggar, 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**., & Saggar, 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., & Saggar, 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.plrev.2015.10.002

In Preparation

Zhang, **M**., Patel, D., Radtke-Schuller, S., & Fröhlich, F. (*In prep*). Alpha and theta oscillations mediate directed interbrain synchronization in socially interacting ferrets.

Zhang, **M**., & Burns, T. (*In prep*). The role of state-space geometry in correlated dense associative memory models.

Invited Talks

Reiling*, J., Fröhlich, F., & **Zhang, M**. (2026, August 25-28). *Topological data analysis captures complex brain and behavioral dynamics during naturalistic social interaction.* (6th International Mobile Brain/Body Imaging Conference, Technische Universität Berlin)

Zhang, M. (2025, November 5). *Computational models of the brain and behavioral dynamics in experimental and clinical settings.* (Cinical Psychology Brown Bag, Michigan State University)

Zhang, M. (2025, September 25-26). *The topology of dynamics in social interaction.* (Montreal Open Tools Symposium, McGill University)

Zhang, M. (2025, August 21). *How does the brain change its mind? an introduction to neuroimaging-informed dynamical systems modeling.* (Cognitive Imaging Research Center, Inaugural Symposium, Michigan State University)

Zhang, M. (2025, July 15). *The whole picture:charting states and transitions in the coordination dynamics of multiple agents and processes.* (Keynote, Team and Multi-agent Dynamics Workshop, Montpellier, France)

Zhang, M. (2025, July 8). *A topological link between models of brain-behavior dynamics.* (Cross-species modeling Workshop, 34th Annual Computational Neuroscience Meeting, Florence, Italy)

Zhang, M. (2025, May 22-25). *Mapping states and transitions: from simple to complex social interaction.* (Symposium: 30 Years of Advancing Behavioral and Social Sciences Research to Improve Health for All, Annual Meeting of the Association for Psychological Science, Washington DC)

Zhang, M. (2025, February 26). *A global topological view on coordination in movement and brain dynamics.* (Robotics and Control Seminar, Michigan State University)

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 brain and behavioral 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)

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For presentations listed below, the presenting author is underlined.

Contributed Conference Talks

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**., Chowdhury, S., & Saggar, 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)

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**., & Saggar, 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**., 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)

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**. (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)

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)

Conference Posters

Reiling*, J., Fröhlich, F., & **Zhang**, **M**. (2025, November 16). *Topological data analysis reveals stable relative postural states during social interaction between freely moving animals.* (Poster, Society for Neuroscience Annual Conference, San Diego, USA)

Stein, A., Schwippel, T., Pupillo, F., **Zhang**, **M**., Rubinow, D., & Fröhlich, F. (2025, April 24-26). *Daily changes in high-density eeg alpha power and functional connectivity across five consecutive days of 10hz transcranial alternating current stimulation in depression: Results from a randomized controlled trial.* (Poster, Society of Biological Psychiatry Annual Conference, Toronto, Canada)

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, Socity 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)

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)

Sun, Y., **Zhang**, **M**., & Saggar, 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)

Zhang, **M**., & Saggar, 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)

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, 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**., & 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.)

Teaching

Michigan State University **Michigan U.S.**
Assistant Professor *2023-present*
CMSE 201 – Computational Modeling and Data Analysis
CMSE 381 – Fundamentals of Data Science Methods
CMSE 801 – Introduction to Computational Modeling and Data Analysis

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

- Organization for Computational Neuroscience (CNS) *2025–present*
- Society for Industrial and Applied Mathematics (SIAM) *2017–2019*
- 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

SBIR/STTR Program **NSF**
Ad-hoc grant reviewer *2025-present*

Collaborative Research in Computational Neuroscience program (CRCNS) **NSF**
Panel grant reviewer *2023-present*
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 **NSF**
Ad-hoc grant reviewer *2019-present*

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

Reviewer for peer-reviewed journals:
Adaptive Behavior, Biological Cybernetics, Brain Stimulation, Cognitive Processing, Cognitive Systems Research, Communications Biology, eLife, European Journal of Neuroscience, Frontiers in Computational Biology, Frontiers in Psychology, Human Movement Science, International Journal of Psychophysiology, Journal of Neuroscience Research, Network Neuroscience, Philosophical Transactions of the Royal Society B, PLOS Computational Biology, PLoS ONE, Physics of Life Reviews, Psychological Science, Scientific Reports.

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 Seminar Colloquium and Brown Bag Committee **Michigan State University**
Committee Member *2025-present*

CMSE AI Education Hire Search Committee **Michigan State University**
Committee Member *2025-present*

CMSE Computational Biology Cluster Hire Search Committee **Michigan State University**
Committee Member *2024-2025*

CMSE DEI Committee **Michigan State University**
Committee Member *2024-2025*

Graduate Student Disseration Committees **Michigan State University**
Committee Member *2023-present*
Current Students: Angqi Li (CMSE Ph.D. program), Cassandra Lem (CMSE Ph.D. program), Derek Bowman (Pharmacology and Toxicology, MD-Ph.D. program), David Munoz Ramirez (CMSE Ph.D. program), Faith Houck (Kinesiology Ph.D. program), Rachel Roca (CMSE Ph.D. program).
Past Students: Maxwell Chumley (Mechenical Engineering & CMSE dual Ph.D. program), Sunia Tanweer (Mechanical Engineering Ph.D. program), Mateja Milicevic (Biosystems Engineering 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/postdocs that I have mentored:

- Joseph McKinley (postdoc, Computational Mathematics, Science and Engineering, Michigan State University) *2026–present*
  Role: Research Mentor
  Topic: Computational modeling of large-scale brain dynamics

- Jacob McLees (Undergraduate student, Data Science, & Neuroscience Program, Michigan State University) *2025–present*
  Role: Research Mentor for MSU Undergraduate Pathway to Research program
  Topic: Neuroimaging data preprocessing and functional connectivity analysis
- Nyla Blagrove (Rotation Master student, Data Science, Michigan State University) *2025*
  Role: Rotation Supervisor
  Topic: Validate Deep-learning based motion tracking with 3D animations.
- Patience Akatuhwera (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) *2024–present*
  Role: Ph.D. advisor.
  Topic: Topological data analysis of brain and social dynamics.
- Atoshi Das (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) *2024–present*
  Role: Ph.D. advisor.
  Topic: Dynamical landscape analysis of brain dynamics.
- Vitika Patel (Undergraduate student, Biochemistry and Molecular Biology/Biotechnology program, Michigan State University) *2024*
  Role: Research co-mentor (with Jared Reiling, Ph.D. student) Topic: Deep-learning based markerless motion tracking.
- Faith Houck (Ph.D. student, Kinesiology, Michigan State University) *2024–present*
  Role: Research advisor on computational data analysis
- Mateja Milicevic (Undergraduate student, transitioned to Ph.D. student, Biosystems Engineering, Michigan State University) *2023-2025*
  Role: Ph.D. co-advisor (Primary advisor: Dr. Jiyoon Yi, MSU) EEG data analysis. Using Hopfield network for missing data imputation.
- Angqi Li (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) *2023–present*
  Role: Research advisor on EEG analysis methods (Primary Ph.D. advisor: Dr. Saiprasad Ravishankar)
- Jared Reiling (Ph.D. student, Computational Mathematics, Science and Engineering, Michigan State University) *2023–present*
  Role: Ph.D. advisor
  Topic: Multiscale computational modeling of animal behavior, deep learning.
- Grace Ross (Ph.D. student, Neuroscience, UNC-CH) *2021–2024*
  Role: Co-mentor (Primary advisor: Dr. Flavio Fröhlich)
  Topic: Electrophysiology time series analyses to study posterior visual network dynamics during visual perception in ferrets.
- Dhruvi Patel (undergraduate student, Biology, UNC-CH) *2022–2023*
  Role: Research mentor
  Topic: Ferret behavior and electrophysiology data collection and analysis.
- Lauren Sidelinger (undergraduate student, Neuroscience/Computer Science, UNC-CH) *2021–2023*
  Role: Research mentor
  Topic: EEG time series analyses to study the long-term stability of resting brain dynamics.
- Preetam Tanikella (undergraduate student, Biostatistics, UNC-CH) *2021–2022*
  Role: Research mentor
  Topic: Electrical and mechanical engineering for animal behavior training box.
- Noah Trexler (undergraduate student, Computer Science, UNC-CH) *2021–2022*
  Role: Research mentor

Topic: Electrical and software engineering for animal behavior training box.

- Mary Enloe (undergraduate student, Computer Science, UNC-CH) *2021*
  Role: Research mentor
  Topic: Mechanical engineering for animal behavior training box.
- Rafi Ayub (graduate student, Bio-engineering, Stanford University) *2019–2020*
  Role: Co-mentor (Primary Ph.D. advisor: Dr. Manish Saggar) Topic: Biophysical network modeling of brain dynamics, assisting.
- Joshua Child (graduate student, Political Sciences, Florida Atlantic University) *2018*
  Role: Research mentor
  Topic: Directed Independent Study on oscillator models of economic inequality.
- Nadine Akin (postgraduate student, Biological Sciences, Florida Atlantic University) *2017-2018*
  Role: Research mentor
  Topic: Analysis of dynamical behavioral data from a social coordination experiment.
- Ananda Chowdhury (undergraduate student, Engineering, Florida Atlantic University) *2015-2016*
  Role: Research mentor
  Topic: Signal processing, and analysis of multiagent interaction data.
- Daniela Herrera (undergraduate student, Neuroscience, Florida Atlantic University) *2015-2016*
  Role: Research mentor
  Topic: 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, ∼100x acceleration), simulation and parameter exploration of differential equations (∼1000x acceleration, **Zhang**, Beetle, Kelso, and Tognoli 2019), and graph matching (∼150x 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, & Saggar, 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)

May 18, 2026