# Shi Chen

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## APPOINTMENTS

**Department of Mathematics, Massachusetts Institute of Technology, Cambridge, MA** Jul 2024- Jun 2027

- Instructor in Applied Mathematics, Mentor: Philippe Rigollet and Laurent Demanet

## EDUCATION

**Department of Mathematics, University of Wisconsin- Madison, Madison, WI** Jul 2018- Jun 2024

- Ph.D. in Applied and Computational Mathematics, Advisor: Qin Li
- Thesis: Multiscale Numerical Methods for Elliptic and Wave-Type PDEs and Their Inverse Problems

**Department of Mathematical Sciences, Tsinghua University, Beijing, China** Sep 2014- Jul 2018

- B.S. in Pure and Applied Mathematics (Second Degree), Advisor: Zhongyi Huang
- Senior Thesis: Modeling and Simulation of Dynamic Property of Metamaterials

**Department of Chemical Engineering, Tsinghua University, Beijing, China** Aug 2013- Jul 2018

- B.Eng. in Polymer Materials and Engineering, Advisor: Li-Tang Yan
- Senior Thesis: Simulation of Movement of Microcapsules in Solution with Enzymatic Reactions

## PUBLICATIONS

- *Bayesian Sampling Using Interacting Particles*
  **Shi Chen**, Zhiyan Ding, Qin Li, arXiv preprint arXiv:2401.13100 (2024).
- *A Good Score Does Not Lead to a Good Generative Model*
  Sixu Li, **Shi Chen**, Qin Li, arXiv preprint arXiv:2401.04856 (2024).
- *Accelerating Optimization over the Space of Probability Measures*
  **Shi Chen**, Qin Li, Oliver Tse, Stephen J. Wright, arXiv preprint arXiv:2310.04006 (2023).
- *Correcting Auto-Differentiation in Neural-ODE Training*
  Yewei Xu, **Shi Chen**, Qin Li, Stephen J. Wright, arXiv preprint arXiv: 2306.02192 (2023).
- *On Optimal Bases for Multiscale PDEs and Bayesian Homogenization*
  **Shi Chen**, Zhiyan Ding, Qin Li and Stephen J. Wright, arXiv preprint arXiv: 2305.12303 (2023).
- *Learning Harmonic Molecular Representations on Riemannian Manifold*
  Yiqun Wang, Yuning Shen, **Shi Chen**, Lihao Wang, Fei Ye, Hao Zhou, *International Conference on Learning Representations 2023 (Poster Accepted)*.
- *On the Global Convergence of Gradient Descent for Multi-Layer ResNets in the Mean-Field Regime.*
  Zhiyan Ding, **Shi Chen**, Qin Li and Stephen J. Wright, arXiv preprint arXiv:2110.02926 (2021).
- *High-Frequency Limit of the Inverse Scattering Problem: Asymptotic Convergence from Inverse Helmholtz to Inverse Liouville*
  **Shi Chen**, Zhiyan Ding, Qin Li, Leonardo Zepeda-Núñez, *SIAM Journal on Imaging Sciences*, 16(1), pp.111-143.
- *Overparameterization of Deep ResNet: Zero Loss and Mean-Field Analysis*
  Zhiyan Ding, **Shi Chen**, Qin Li and Stephen J. Wright, *Journal of Machine Learning Research*, 2022.
- *A Reduced Order Schwarz Method for Nonlinear Multiscale Elliptic Equations Based on Two-Layer Neural Networks*
  **Shi Chen**, Zhiyan Ding, Qin Li and Stephen J. Wright, *Journal of Computational Mathematics*, DOI: 10.4208/jcm.2204-m2021-0311 (2022).
- *Low-Rank Approximation for Multiscale PDEs*
  Ke Chen, **Shi Chen**, Qin Li, Jianfeng Lu, and Stephen J. Wright, *Notices of the American Mathematical Society*, 69(6).
- *Manifold Learning and Nonlinear Homogenization*
  **Shi Chen**, Qin Li, Jianfeng Lu, and Stephen J. Wright, *Multiscale Modeling & Simulation*, 20(3), pp.1093-1126.

- *Semiclassical Limit of an Inverse Problem for the Schrödinger Equation*
  **Shi Chen** and Qin Li, *Research in the Mathematical Sciences*, 8 (3), 1-18, 2021.
- *State-Specific Projection of COVID-19 Infection in the United States and Evaluation of Three Major Control Measures*
  **Shi Chen**, Qin Li, Song Gao, Yuhao Kang and Xun Shi, *Scientific Reports*, 10 (1), 1-9, **the Top 100 Most Highly Accessed Papers** in 2020 from *Scientific Reports*.
- *Classical Limit for the Varying-Mass Schrödinger Equation with Random Inhomogeneities*
  **Shi Chen**, Qin Li and Xu Yang, *Journal of Computational Mathematics*, 438, 110365, 2021.
- *How Implementation of Entropy in Driving Structural Ordering of Nanoparticles Relates to Assembly Kinetics: Insight into Reaction-Induced Interfacial Assembly of Janus Nanoparticles*
  Ye Yang, Pengyu Chen, Yufei Cao, Zihan Huang, Guolong Zhu, Ziyang Xu, Xiaobin Dai, **Shi Chen**, Bing Miao, and Li-Tang Yan, *Langmuir*, 2018, 34, 32, 9477–9488

## PRESENTATIONS

- **Graduate Applied Math Seminar, Univ. of Wisconsin-Madison** Oct 2023
  Talk: A Tutorial on Optimization over the Space of Probability Measures
- **Workshop on Stability Analysis for Nonlinear PDEs across Multiscale Applications, Penn. State** Oct 2023
  Talk: Accelerating Optimization over the Space of Probability Measures
- **IFDS Ideas Forum, Univ. of Wisconsin-Madison** Sep 2023
  Talk: Accelerating Optimization over the Space of Probability Measures
- **IFDS Annual Meeting, Univ. of Wisconsin-Madison** Sep 2023
  Poster: Hamiltonian Flows for Optimizing Probability Measures
- **AIMS Special Session on Data-driven Methods in Dynamical Systems, UNC, Wilmington** Jun 2023
  Talk: Zero-loss Neural Network Training in the Mean-field Regime
- **Inaugural CAMDA Conference, Texas A&M University** May 2023
  Talk: Zero-loss Neural Network Training in the Mean-field Regime
- **The Midwest Machine Learning Symposium (MMLS 2023), Univ. of Illinois, Chicago** May 2023
  Poster: Global Convergence of Gradient Descent for Multi-Layer ResNets with Homogeneous Activation Functions in the Mean-Field Regime
- **The International Conference on New Trends in Computational and Data Sciences, Caltech** Dec 2022
  Poster: High-frequency Limit of the Inverse Scattering Problem -- from Inverse Helmholtz to Inverse Liouville
- **SIAM Student Chapter Seminar, Univ. of Wisconsin-Madison** Feb 2022
  Talk: Classical Limits of Direct and Inverse Wave Type Problems -- A Wigner Transform Approach
- **IMA Workshop of Mathematical Foundation and Applications of Deep Learning, Purdue Univ. (Virtual)** Aug 2021
  Poster Talk: A Reduced Order Schwarz Method for Nonlinear Multiscale Elliptic Equations Based on Two-Layer Neural Networks
- **IFDS Ideas Forum, Univ. of Wisconsin-Madison** Apr 2021
  Talk: Low-Dimensional Approximation to PDE Solution Manifold
- **SIAM Conference on Computational Science and Engineering (Virtual)** Mar 2021
  Poster: Low-Dimensional Approximation to PDE Solution Manifold
- **Data Science Research Bazaar, Univ. of Wisconsin-Madison** Feb 2021
  Poster: State-Specific Projection of COVID-19 Infection in the United States and Evaluation of Three Major Control Measures

## CONFERENCE AND MINI-SYMPOSIUM ORGANIZED

- **AIMS Special Session on Data-driven Methods in Dynamical Systems, UNC, Wilmington** Jun 1, 2023

## HONORS AND AWARDS

- *Excellence in Research Graduate Student Awards*, University of Wisconsin-Madison 2024
- *Excellence in Research Graduate Student Awards*, University of Wisconsin-Madison 2023

- *Student Travel Support*, AIMS Conference on Dynamical Systems, Differential Equations and Applications 2023
- *Student Travel Award*, 2021 SIAM Annual Meeting (Virtual) 2021
- *Student Travel Award*, 2021 SIAM Conference on Computational Science and Engineering (Virtual) 2021
- *Schaerf Research Award*, University of Wisconsin-Madison, 0.5K 2020
- *Physical Sciences Award*, University of Wisconsin-Madison, 2.5K 2019
- *Academic Excellence Award*, Tsinghua University, China 2016
- *Evergrande Group Scholarship*, Tsinghua University, China, 5K 2015
- *China National Petroleum Scholarship*, Rank 2/110, Tsinghua University, China, 8K 2014
- *First Prize, National Undergraduate Physics Contest*, Beijing, China 2014

## TEACHING EXPERIENCE

**Department of Mathematics, University of Wisconsin- Madison, Madison, WI**

- Teaching Assistant, MATH221, Calculus and Analytic Geometry I Fall 2018, Spring 2020, Fall 2020
- Teaching Assistant, MATH222, Calculus and Analytic Geometry II Spring 2019
- Teaching Assistant, MATH234, Calculus and Analytic Geometry III Fall 2021
- Teaching Assistant, MATH240, Introduction to Discrete Mathematics Spring 2023
- Lecturer Student Assistant, MATH112, Algebra Fall 2023, Spring 2024

## INDUSTRIAL EXPERIENCE

**ByteDance AI Lab, Mountain View, CA (Virtually)** May 2022- Nov 2022

- Research Scientist Internship with the Drug AI Team. Mentor: Yiqun Wang

## PROFESSIONAL SERVICE AND OUTREACH

Organizer, SIAM Student Chapter, University of Wisconsin- Madison, Madison, WI Aug 2023- Jul 2024

## SKILLS

- Programming Languages: Python (PyTorch, JAX), Matlab, Fortran, C
- Tools: LaTex, AWS Cloud Computing, Azure Cloud Computing, Linux

## LANGUAGES

English (Full professional proficiency), Chinese (Mandarin and Cantonese, Native proficiency)