

CONTACT INFORMATION	Department of Mathematics Florida State University James Jay Love Building, 208, 1017 Academic Way, Tallahassee, FL 32306	✉ E-mail: sliu11@fsu.edu Google scholar
EDUCATION	Georgia Institute of Technology , GA, USA • Ph.D. in Computational Science and Engineering, home unit in School of Mathematics • Advisor: Prof. Haomin Zhou. Zhejiang University (Chu Kochen Honors College) , China. • B.Sc., Mathematics & Applied Mathematics . • Thesis advisor: Daoyuan Fang.	August 2016– May 2022 August 2012–June 2016
EMPLOYMENT	Assistant Professor, Florida State University Hedrick Assistant Adjunct Professor, UCLA	August 2025 - July 2022 - June 2025
RESEARCH INTERESTS	My research focuses on scientific computing, numerical analysis, and machine learning, with an emphasis on efficient, scalable algorithms for partial differential equations (PDEs). <ul style="list-style-type: none"> • Design numerical methods with accuracy guarantees for simulating Wasserstein geometric flows. • Primal-dual algorithms for numerical PDEs, including classical and machine learning methods. I am also interested in sampling and optimal control problems on discrete graphs.	
PUBLICATIONS	Published (Journal papers) <ul style="list-style-type: none"> • Hao Wu, Shu Liu, Xiaojing Ye, Haomin Zhou. Parametrized Wasserstein Hamiltonian flow. SIAM Journal on Numerical Analysis Vol. 63, Iss. 1 pp.360-395, 2025. paper link, arXiv: 2306.00191, 2023. • Yijie Jin, Shu Liu, Hao Wu, Xiaojing Ye, Haomin Zhou. Parameterized Wasserstein Gradient Flow. Journal of Computational Physics, 2024. paper link, arXiv: 2404.19133. • Shu Liu, Siting Liu, Stanley Osher, Wuchen Li. A first-order computational method for Reaction-Diffusion type equations via Primal-Dual Hybrid Gradient method. Journal of Computational Physics Volume 500, 1 March 2024, 112753. paper link, arXiv: 2305.03945, 2023. • Jianbo Cui, Shu Liu, Haomin Zhou. Optimal control for stochastic nonlinear Schrodinger equation on graph. SIAM Journal on Control and Optimization Vol. 61, Iss. 4, pp. 2021–2042, 2023. paper link, arXiv:2209.05346, 2022. • Jianbo Cui, Shu Liu, Haomin Zhou. Stochastic Wasserstein Hamiltonian Flows. Journal of Dynamics and Differential Equations, paper link, arXiv: 2111.15163. • Jiaojiao Fan*, Shu Liu*, Shaojun Ma, Haomin Zhou, and Yongxin Chen. Neural Monge Map estimation and its applications. Transaction on Machine Learning Research Featured Certification. Openreview, arXiv:2106.03812, 2021. * Equal contribution. A short version is published at ICLR 2022 Workshop on Deep Generative Models for Highly Structured Data (DGM4HSD). Openreview. • Jianbo Cui, Shu Liu, Haomin Zhou. Wasserstein Hamiltonian flow with common noise on graph. SIAM Journal on Applied Mathematics, Vol. 83, Iss. 2 pp. 484 - 509, 2023. paper link, arXiv:2204.01185. • Shu Liu, Wuchen Li, Hongyuan Zha, and Haomin Zhou. Neural parametric Fokker-Planck equations. SIAM Journal on Numerical Analysis, Vol. 60, Iss. 3, pp. 1385-1449, 2022. paper link, arXiv:2002.11309,2020. SIAM Student Paper Prize A shorter version is published in Geometric Science of Information, pages 715–724, Cham, 2019. Springer International Publishing. Link, arXiv: 1903.10076. • Jianbo Cui, Shu Liu, and Haomin Zhou. What is a stochastic Hamiltonian process on finite graph? An optimal transport answer. Journal of Differential Equations, Vol. 305, 25 December 2021, Pages 428-457. paper link, arXiv: 2101.08420. 	

Published (Conference papers)

- Shu Liu*, Haodong Sun*, and Hongyuan Zha. A particle-evolving method for approximating the optimal transport plan. **Geometric Science of Information**, pages 878–887, Cham, 2021. Springer International Publishing. [Link](#). Complete version at [arXiv:2105.06088, 2021](#). * Equal contribution.
- Shaojun Ma, Shu Liu, Hongyuan Zha, and Haomin Zhou. Learning stochastic behaviour from aggregate data. Proceedings of the 38th International Conference on Machine Learning (**ICML**), volume 139 of Proceedings of Machine Learning Research, pages 7258–7267. PMLR, 18–24 Jul 2021. [Link](#).

Preprints

- Yesom Park, Shu Liu, Mo Zhou, Stanley Osher. Neural Hamilton–Jacobi Characteristic Flows for Optimal Transport. [arXiv:2510.01153](#)
- Hao Wu, Shu Liu, Xiaojing Ye, Haomin Zhou. A parametrized Wasserstein Hamiltonian flow approach for solving the Schrödinger equation. [arXiv:2505.11762v2](#)
- Shu Liu, Stanley Osher, Wuchen Li. A Natural Primal-Dual Hybrid Gradient Method for Adversarial Neural Network Training on Solving Partial Differential Equations. [arXiv: 2411.06278](#)
- Xinzhe Zuo, Jiayi Zhao, Shu Liu, Stanley Osher, Wuchen Li. Numerical Analysis on Neural Network projected schemes for approximating one dimensional Wasserstein Gradient Flows. [arXiv: 2402.16821](#). Submitted.
- Jianbo Cui, Shu Liu, Haomin Zhou. A supervised learning scheme for computing Hamilton–Jacobi equation via density coupling. [arXiv: 2401.15954](#). Accepted by **SIAM Journal on Scientific Computing**.
- Shu Liu, Xinzhe Zuo, Stanley Osher, Wuchen Li. Numerical analysis of a first-order computational algorithm for reaction-diffusion equations via the primal-dual hybrid gradient method. Accepted by **Mathematics of Computation**, July 11, 2025. [paper link](#), [arXiv: 2401.14602](#).
- Shu Liu*, Shaojun Ma*, Yongxin Chen, Hongyuan Zha, and Haomin Zhou. Learning high dimensional Wasserstein geodesics. [arXiv:2102.02992, 2021](#). * Equal contribution.

TALKS & CONFERENCES ATTENDED

- FSU Department of Mathematics, Applied and Computational Math seminar, October 21, 2025. Tallahassee, Florida, U.S.
- SIAM Conference on Applications of Dynamical Systems (DS25), May 11–15, 2025. Denver, Colorado, U.S.
- Department of Mathematics Colloquium, Florida State University, January, 31, 2025.
- Department of Mathematics & Statistics seminar at Auburn University, December 9, 2024.
- CCoM and CSME Seminars at UCSD, November 12, 2024.
- AMS Fall Western Sectional Meeting at UCR, October 26-27, 2024.
- SIAM Conference on Mathematics of Data Science (MDS24), October 21-25, 2024.
- The 9th SIAM Central States Section Annual Meeting at UMKC, October 5-6, 2024.
- 2024 SIAM Annual Meeting (AN24), July 8 - 12, 2024.
- Interacting Particle Systems: Analysis, Control, Learning and Computation, ICERM, May 6 - 10, 2024.
- Southern California Applied Mathematics Symposium (SOCAM), UCSD, Saturday, April 27th, 2024.
- International Conference on Multiscale Modeling and Simulation based on Physics and Data, IPAM, UCLA, April 25 - 26, 2024.
- RTG Seminars on Data Science, University of South Carolina, April 19, 2024.
- Scientific Computing and Large Data workshop, University of South Carolina, December 16-22, 2023.

- PDE & Applied Mathematics seminar at UCR, October 25, 2023.
- SIAM New York-New Jersey-Pennsylvania Section 2023 Annual Meeting, October 21, 2023.
- ICIAM Minisymposium Mean field games and optimal transport with applications in data science and biology, August 21, 2023.
- SIAM conference on Data science and mathematics, September 26, 2022.
- SIAM Southeastern Atlantic Section Conference, Auburn University, AL, USA, September 18 - 19, 2021.
- Geometric Science of Information 5th International Conference, GSI 2021, Sorbonne University, Paris, France, July 21 - 23, 2021.
- Remote participation in the Long Program on high dimensional Hamilton-Jacobi PDEs at IPAM, UCLA, CA, USA, March 9 - June 12, 2020.
- Geometric Science of Information 4th International Conference, GSI 2019, Ecole Nationale de l'Aviation Civile, Toulouse, France, August 27 -29, 2019.
- Participation in Graduate Summer School: Mean Field Games and Applications at IPAM, UCLA, CA, USA, June 18 - 29, 2018.

HONORS AND AWARDS	• SIAM Student Paper Prize (A spotlight can be found at this link.)	2024
	• (Georgia Tech School of Mathematics) Best PhD thesis	2022
	• (Georgia Tech School of Mathematics) Top Graduate Student Award	2021
	• (Georgia Tech School of Mathematics) Outstanding Student Evaluation for Spring 2018	2018
	• The 6th National College Students Mathematical Competition, Final round, First prize	2015
	• 2014 Mathematical Contest in Modeling, SIAM Prize Recipient, with Yuan Gong and Yandi Shen	2014

TEACHING RECORDS	At FSU (2025-)	
	Instructor for MAC 2311 Calculus I	
	At UCLA (2022-2025)	
	Instructor for PIC 10A Introduction to programming (C++)	
	Instructor for PIC 20A Java Language and its application	
	At Georgia Institute of Technology (2016-2022)	
	TA for MATH 2551 [Multivariable Calculus]	
	TA for MATH 2552 [Differential Equations]	
	TA for MATH 1551 [Differential Calculus]	
	TA for MATH 1552 [Integral Calculus]	

REVIEW SERVICE	I used to be the reviewer for the following journals. (The numbers in parentheses indicate the number of papers I have reviewed for each journal.)	
	• Inverse Problems and Imaging (2),	
	• Applied and Computational Harmonic Analysis (1),	
	• Journal of Computational Physics (2),	
	• Communications on Applied Mathematics and Computation (1),	
	• SIAM Journal on Scientific Computing (1),	
	• SIAM Journal on Image Sciences (1),	
	• Journal of Machine Learning (1),	
	• Entropy (1),	
	• Engineering Applications of Artificial Intelligence (1).	

SKILLS	Python (Proficient), \LaTeX (Proficient), MATLAB (Proficient), C++ (Competent), Java (Competent).
LANGUAGE	Chinese (Mother tongue), English (Fluent).