

# ZEXI FAN

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Personal Homepage

X | Github | LinkedIn

## EDUCATION

**Peking University (PKU)**

Sep 2022 – Present

B.S. in Computational Mathematics; Major GPA: 3.6 / 4.0

GRE: 164(Q) / 169(V) / 4.0(A)

Aug 2023

Selected high-grade Abstract Algebra (93), Machine Learning (93), Advanced Algebra II (90).

## PUBLICATIONS

**Zexi Fan**, Yan Sun, Shihao Yang, Yiping Lu. *Physics-Informed Inference Time Scaling via Simulation-Calibrated Scientific Machine Learning*. Preprint, Apr 2025.

**Zexi Fan**, Jianfeng Lu. *Accelerating Non-equilibrium Steady State Sampling in Quantum Markov Processes through Second-Order Lifting*. In preparation, 2025.

**Zexi Fan**, Ying Jin. *Pessimistic Policy Learning for Continuous-Action Bandit Problems without Uniform Overlap*. In preparation, 2024–Present.

## RESEARCH EXPERIENCE

**Accelerating NESS sampling via Second-Order Lifting**

Jul 2025 – Present

Advisor: Prof. Jianfeng Lu

Duke

- Developed a second-order lifting framework for Lindbladian dynamics to accelerate convergence to NESS; derived spectral-gap improvements using hypocoercivity and flow-Poincaré arguments.

**Continuous-State Contextual Bandit with Pessimism Regularization**

Aug 2024 – Present

Advisor: Prof. Ying Jin

Harvard

- Extended pessimism regularization to continuous-state/action settings; proved suboptimality guarantees without the uniform overlap assumption and developed tailored concentration bounds.

**Simulation-Calibrated Scientific Machine Learning (SCaSML)**

Jun 2024 – Apr 2025

Advisors: Prof. Yiping Lu, Dr. Yan Sun

Northwestern & Georgia Tech

- Proposed SCaSML to calibrate PINN surrogates via randomized MLMC and Multilevel Picard; established improved complexity scaling and validated on multiple 100d+ PDEs. Code: SCaSML.

**Flow-Calibrated RL for Transition Path Sampling**

Feb 2024 – Jun 2024

Prof. Yiping Lu, Dr. Dinghuai Zhang

NYU Courant & Mila

- Reformulated transition-path sampling as a Schrödinger-bridge problem; developed continuous SAC and GFlowNet variants guided by flow calibration.

**Unbiased Square-Root Convergent Estimation for High-Dimensional PDEs via randomized MLMC**

Sep 2023 – Feb 2024

Prof. Yiping Lu

NYU Courant

- Combined Multilevel Picard iteration with randomized MLMC to construct an unbiased estimator with bounded variance.

SELECTED COURSEWORK & ACADEMIC ACTIVITIES

Graduate-level: High Dimensional Probability; Applied Stochastic Analysis; Optimization Methods; Mathematical Image Processing; Machine Learning.  
Seminars: Stochastic Optimal Control; LLMs & Scientific Computing; Blowup in Fluid Equations.  
Summer school: Beauty of Theoretical Computer Science (NJU), Summer 2024.

TECHNICAL SKILLS

Programming	Python, MATLAB, L <sup>A</sup> T <sub>E</sub> X, Bash, Markdown
Libraries	PyTorch, JAX, NumPy, SciPy, DeepXDE, WandB
Numerical	Multilevel Picard, MLMC, Gurobi, Mosek
Math Tools	Stochastic analysis, hypocoercivity, concentration inequalities, optimal transport
Languages	Mandarin (native), English (fluent)

SERVICE & LEADERSHIP

Academic & Innovation Dept., SMS Student Union	Spring 2023
English Debate Club	Summer 2024