Fei Cao

University of Massachusetts Amherst
Department of Mathematics and Statistics
MA 01003, USA

Phone: 480-430-4855
Mobile: 480-430-4855

Email: fcao@umass.edu
Google Scholar Profile: Fei Cao

Born: January 13, 1995 in Hubei (China)
Nationality: Chinese

Current position

Visiting Assistant Professor, University of Massachusetts Amherst, Amherst, MA, USA.

Research interests

- Interacting particle systems
- Derivation of macroscopic models (from kinetic to fluid models)
- Applications of ordinary and partial differential equations

Employment

2022-2025 Visiting Assistant Professor at the University of Massachusetts Amherst
2017-2022 Teaching Assistant at Arizona State University

Education

2017-2022 PH.D in Applied Mathematics, Arizona State University.
2013-2017 BACHELOR in Applied Mathematics, Southwestern University of Finance and Economics.

Publications

2020 F. Cao, S. Motsch, A. Reamy, R. Theisen, *Asymptotic flocking for the three-zone model*, Mathematical Biosciences and Engineering, AIMS Press, 17 (6) (**2020**) 7692–7707.
2021 F. Cao, *K-averaging agent-based model: propagation of chaos and convergence to equilibrium*, Journal of Statistical Physics, Springer, 184 (2) (**2021**) 1–19.

2022 F. Cao, *Explicit decay rate for the Gini index in the repeated averaging model*, Mathematical Methods in the Applied Sciences, 46 (4) (**2023**) 3583–3596.

2023 F. Cao, P-E. Jabin, S. Motsch, *Entropy dissipation and propagation of chaos for the uniform reshuffling model*, Mathematical Models and Methods in Applied Sciences, 33 (4) (**2023**) 829–875.

2023 F. Cao, S. Motsch, *Derivation of wealth distributions from biased exchange of money*, Kinetic & Related Models, 16 (5) (**2023**) 764–794.

2023 F. Cao, S. Motsch, *Uncovering a two-phase dynamics from a dollar exchange model with bank and debt*, SIAM Journal on Applied Mathematics, 83 (5) (**2023**) 1872–1891.

2024 F. Cao, N. Marshall, *From the binomial reshuffling model to Poisson distribution of money*, Networks and Heterogeneous Media, 19(1) (**2024**) 24–43.

2024 F. Cao, R. Cortez, *Uniform propagation of chaos for a dollar exchange econophysics model*, European Journal of Applied Mathematics, (**2024**) 1–13.

Pre-prints

2022 F. Cao, P-E. Jabin, *From interacting agents to Boltzmann-Gibbs distribution of money*, submitted (**2022**)

2023 F. Cao, S. Reed, *A biased dollar exchange model involving bank and debt with discontinuous equilibrium*, submitted (**2023**)

2024 F. Cao, X. Gong, *On the equivalence between Fourier-based and Wasserstein distances for probability measures on* $\mathbb{N}$, submitted (**2024**)

2024 F. Cao, S. Motsch, *Sticky dispersion on the complete graph: a kinetic approach*, submitted (**2024**)

2024 F. Cao, J. Yang, *Quantitative convergence guarantees for the mean-field dispersion process*, submitted (**2024**)

Working in progress

2024 F. Cao, R. Cortez, *Emergence of fractal structures from an interacting opinion dynamics* (tentative title).

2024 F. Cao, S. Reed, *Emergence of opinion consensus and polarization for a one-parameter family of Sznaid models* (tentative title).

Teaching experience

2018 **Teaching Assistant**, *Applied Probability and Stochastic Processes*, Arizona State University

2019 **Recitation Instructor**, *Precalculus* (Math 171), Arizona State University

2020 **Teaching Assistant**, *Introduction into Deep Neural Networks*, Arizona State University

2021 **Teaching Assistant**, *Ordinary Differential Equations*, Arizona State University

2022 **Instructor**, *Calculus II*, University of Massachusetts Amherst

2023 **Instructor**, *Ordinary Differential Equations*, University of Massachusetts Amherst

Miscellaneous

2023

Visiting Scholar in the School of Mathematical and Statistical Sciences at Arizona State University (11/06/2023 - 11/10/2023), hosted by Associate Professor Sebastien Motsch.

2022 **Visiting Scholar** in the Department of Mathematics at The Pennsylvania State University (02/02/2022 - 02/18/2022), hosted by Professor Pierre-Emmanuel Jabin.

2022 **Graduate Student Research Award** awarded by School of Mathematical and Statistical Sciences at Arizona State University.

2023 **REU mentor** during summer 2023, the undergraduate mentee Minh Le is guided to work on gradient descent and related optimization algorithms.

Skills

- **Computer:** LaTeX
- **Programming:** Julia, Matlab, Python
- **Language:** English (fluent), Chinese (native language), Japanese (basic)

Referee Service for

- Mathematical Modelling of Natural Phenomena
- Methods and Applications of Analysis
- Networks and Heterogeneous Media
- SIAM Journal on Applied Mathematics

Invited Talks

Tufts Ergodic and Dynamical Systems Seminar *Fall 2023*
Invited talk on November 28, 2023 at Tufts University, Boston, USA.

Conferences and Summer Schools

Graduate Student Probability Conference 2024 *Fall 2024*
Two days conference on probability theory at University of Wisconsin–Madison, Madison, USA.

Advances in Probability Theory and Interacting Particle Systems *Summer 2024*
Three days workshop on probability theory and interacting particle systems at Harvard University, Boston, USA.

13th Cornell Probability Summer School *Summer 2024*
Two weeks workshop on probability theory and related fields at Cornell University, Ithaca, USA.

Recent Progress in Stochastic Analysis and its Applications *Summer 2024*
One week workshop on stochastic analysis at Loyola University Chicago, Chicago, USA.

Mathematical Problems in Industry (MPI) Workshop *Summer 2024*
One week workshop on problems of interest to science and industry at the University of Vermont, Burlington, USA.

The 52nd John H. Barrett Memorial Lectures *Summer 2024*
Three days workshop on stochastic analysis and its application at the University of Tennessee,

Knoxville, USA.

ICERM Topical Workshop "Interacting Particle Systems: Analysis, Control, Learning and Computation" *Spring 2024*

One week workshop on interacting particle systems at the Institute for Computational and Experimental Research in Mathematics, Rhode Island, USA.

49th Annual New York State Regional Graduate Mathematics Conference *Spring 2024*

One day conference on mathematics focusing on graduate research at Syracuse University, Syracuse, USA.

2024 Seminar on Stochastic Processes *Spring 2024*

Three days conference on stochastic processes at Rice University, Houston, USA.

Probability and Algebra: New Expressions in Mathematics *Summer 2023*

One week workshop in analysis and probability at Texas A&M University, Texas, USA.

21st International Conference on Random Structures & Algorithms *Summer 2023*

One week conference on random structures and algorithms at Carnegie Mellon University, Pennsylvania, USA.

Current Developments in Mathematics 2023 *Spring 2023*

Two days conference on mathematics at Harvard University, Boston, USA.

2023 Seminar on Stochastic Processes *Spring 2023*

Three days conference on stochastic processes at University of Arizona, Tucson, USA.

2022 Fall Eastern Sectional Meeting *Fall 2022*

Two days AMS sectional meeting at University of Massachusetts Amherst, Amherst, USA.

2022 PIMS-IFDS-NSF Summer School on Optimal Transport *Summer 2022*

Two weeks summer school on optimal transport at Seattle, Washington, USA.

2022 MRC Conference: Data Science at the Crossroads of Analysis, Geometry, and Topology *Summer 2022*

One week workshop on mathematics, statistics, and related fields at Beaver Hollow Conference Center, Java Center, NY, USA.

2022 Seminar on Stochastic Processes *Spring 2022*

Three days conference on stochastic processes at Lehigh University, Pennsylvania, USA.

2021 Frontier Probability Days *Fall 2021*

Three days conference on probability theory and related fields at University of Nevada, Las Vegas, USA.

2021 Blackwell Tapia Conference *Fall 2021*

Three days conference focusing on diversity in mathematics at UCLA, California, USA.

2021 CRM-PIMS Summer School in Probability (Online) *Summer 2021*

Four weeks graduate summer school at the Mathematical Sciences Research Institute (MSRI), Canada.

2021 Summer Program in Partial Differential Equations (Online) *Summer 2021*

Two weeks of concentrated study of topics in analysis at graduate level, USA.

2021 AMS Short Course on Mathematical and Computational Methods for Complex Social Systems (Online) *Spring 2021*

Three days short course at the American Mathematical Society (AMS), USA.

2020 Introduction to water waves graduate summer school (Online) *Summer 2020*

Two weeks graduate summer school at the Mathematical Sciences Research Institute (MSRI), Berkeley, USA.

2020 Summer School: Ergodic Theory via Continued Fractions (Online) *Summer 2020*

One week graduate summer school at the University of North Carolina Greensboro, North Car-

olina, USA.

2020 Hot Topics: Optimal transport and applications to machine learning and statistics (Online) *Summer 2020*

One week workshop at the Mathematical Sciences Research Institute (MSRI), Berkeley, USA.

45-th Annual New York State Regional Graduate Mathematics Conference (Online) *Spring 2020*

One day conference on mathematics focusing on graduate research at Syracuse University, Syracuse, USA.

2020 Seminar on Stochastic Processes *Spring 2020*

Three days seminar on stochastic processes at the Michigan State University, Michigan, USA.

2019 AARMS Summer School on Dynamical Systems, Differential Equations, and Special Functions *Summer 2019*

Four weeks summer school on dynamical systems, differential equations, and special functions at Charlottetown, Prince Edward Island, Canada.

2019 RMMC Summer School on Inverse Problems in Imaging *Summer 2019*

One week summer school on inverse problems at Laramie, Wyoming, USA.

2019 Interacting Particle Systems, Statistical Mechanics and Related Topics *Spring 2019*

Three days conference on interacting particle systems at UCLA, California, USA.

2018 Advances in Asymptotic Probability *Winter 2018*

One week conference on theory of Asymptotic Probability at Stanford, California, USA.

2018 Institute for Advanced Study *Summer 2018*

IAS/PCMI 2018: Harmonic Analysis, Park City, Utah, USA.

2018 Boston City Limits *Summer 2018*

Two weeks summer School on Mathematical General Relativity and the Geometric Analysis of Waves of Fluids at MIT, Boston, USA.

Short Course on Free Boundary Problems *Summer 2017*

Free boundary problems in mathematical finance, Cheng Du, China.

References

Professor Pierre-Emmanuel Jabin
Department of Mathematics and Huck Institutes
Pennsylvania State University
109 McAllister University Park #302
PA 16802, USA
pejabin@psu.edu

Professor Nicolas Lanchier
School of Mathematical and Statistical Sciences
Arizona State University
900 S Palm Walk
AZ 85287-1804, USA
Nicolas.Lanchier@asu.edu

Associate Professor Sebastien Motsch (Ph.D advisor)
School of Mathematical and Statistical Sciences
Arizona State University
900 S Palm Walk
AZ 85287-1804, USA
smotsch@asu.edu