# Peter S. Morfe

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**Research areas:** partial differential equations, probability and stochastic processes

## Employment

2024—Present Postdoctoral Fellow
Max Planck Institute for Mathematics in the Sciences, Leipzig, DE

2022—2024 NSF Postdoctoral Fellow
Max Planck Institute for Mathematics in the Sciences, Leipzig, DE
Sponsoring Scientist: F. Otto

## Education

PhD in Mathematics, University of Chicago, 2022
Thesis Advisor: P.E. Souganidis

MS in Mathematics, University of Chicago, 2018

BE in Electrical Engineering, Cooper Union, 2016

## Grants and Awards

2022 NSF Mathematical Sciences Postdoctoral Research Fellowship

2021 William Rainey Harper Dissertation Fellowship, University of Chicago

2020 SIAM Student Travel Grant

2016 Outstanding Student Poster Presentation, Joint Mathematics Meetings

2011 Full-tuition Scholarship, Cooper Union

## Publications and Preprints

"A Critical Drift-Diffusion Equation: Connections to the Diffusion on $\mathbf{SL}(2)$," with F. Otto and C. Wagner, preprint (2024): arXiv:2410.15983.

"Diffuse Interface Energies with Microscopic Heterogeneities: Homogenization and Rare Events," with C. Wagner, preprint (2024): arXiv:2408.14914.

"Comparison Principles for the Finsler Infinity Laplacian with Applications to Minimal Lipschitz Extensions," preprint (2024): arXiv:2405.05684.

"The Gaussian free-field as a stream function: continuum version of the scale-by-scale homogenization result," with F. Otto and C. Wagner, preprint (2024): arXiv:2404.00709.

"The Gaussian free-field as a stream function: asymptotics of effective diffusivity in infra-red cut-off," with G. Chatzigeorgiou, F. Otto, L. Wang, to appear in *Ann. Probab.* (2024).

"Comparison principles for second order elliptic/parabolic PDE with discontinuities in the gradient compatible with Finsler norms," with P.E. Souganidis, *J. Funct. Anal.* **285**-4 (2023).

"Hamilton-Jacobi scaling limits of Pareto peeling in 2D," with A. Bou-Rabee, *Probab. Theory Relat. Fields* **188** (2024): 235-307.

"The occurence of surface tension discontinuities and degenerate mobilities for Allen-Cahn and mean curvature flows in periodic media," with W.M. Feldman, *Interfaces Free Boundaries* **25**-4 (2023): 567-631.

"On the homogenization of second order level-set PDE in periodic media," preprint (2020): arXiv:2011.15062.

"Homogenization of the Allen-Cahn equation with periodic mobility," *Calc. Var. Partial Differ. Equ.* **61**-110 (2022).

"A Variational Principle for Pulsating Standing Waves and an Einstein Relation in the Sharp Interface Limit," *Arch. Ration. Mech. Anal.* **244** (2022): 919–1018.

"Surface tension and Γ-Convergence for van der Waals-Cahn-Hilliard Phase Transitions in Stationary Ergodic Media," *J. Stat Phys.* **181** (2020): 2225–2256.

"Convergence and Rates for Hamilton-Jacobi Equations on Networks," *NoDEA Nonlinear Differential Equations Appl.* **27**-10 (2020): 1–69.

"Limiting distributions for countable state topological Markov chains with holes," with M. Demers, C.J. Ianzano, P. Mayer, and E.C. Yoo, *Discrete and Cont. Dynam. Sys.* **37**-1 (2017): 105–130.

## Invited Talks

**Conferences**

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|---|---|
| August 2023 | International Congress on Industrial and Applied Mathematics, Tokyo |
| June 2023 | Interacting Particles, Fluctuating Systems, and SPDE, Oxford University |
| May 2023 | Madison Workshop in PDE, University of Wisconsin, Madison |
| March 2022 | SIAM Conference on Analysis of Partial Differential Equations, Berlin |
| May 2021 | SIAM Conference on Mathematical Aspects of Materials Science, Bilbao |
| March 2021 | Homogenization Theory: Periodic and Beyond, Oberwolfach |

**Colloquia**

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| September 2024 | Computational and Applied Mathematics Colloquium, Penn State |
| June 2024 | CRC 1114 Colloquium, Free University of Berlin |

**Seminars**

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| May 2024 | $n$-Cities Seminar, Leipzig, DE |
| February 2024 | Probability Seminar, University of Warwick |
| October 2023 | Applied Mathematics Seminar, University of Utah |
| May 2023 | Analysis Seminar, Courant Institute |
| May 2023 | PDE Seminar, Purdue University |
| February 2023 | Probability Seminar, Cornell University |
| January 2023 | Stochastics Seminar, University of Münster, DE |

December 2022 Applied Mathematics Seminar, University of Freiburg, DE
May 2022 Calderón-Zygmund Seminar, University of Chicago
January 2022 Centre for Nonlinear Analysis Seminar, Carnegie Mellon University
November 2021 PDE Seminar, University of Minnesota
September 2021 Applied Analysis Seminar, Max Planck Institute, Leipzig, DE
June 2021 Applied Mathematics Seminar, University of Freiburg, DE
May 2021 Probability Seminar, Northwestern University

## Teaching Experience

### Teaching at University of Chicago

Spring 2020 Teaching Asisstant
Undergraduate numerical analysis (MATH 211)

2019—2020 Instructor
Instructor of record for Calculus I and II (MATH 151 and 152)

2018—2019 Instructor
Instructor of record for Calculus I, II, and III (MATH 151–153)

2017—2018 College Fellow
Teaching assistant for honors analysis sequence (MATH 207–209)

## Mentoring and Outreach

June 2024 Lecturer, University of Chicago Math REU
One week course on tug-of-war and the infinity Laplacian

2017, '20, '22 REU Mentor, University of Chicago Math REU
Supervised three undergraduates in '17, two in '20, three in '22

August 2021 Lecturer, University of Chicago Math REU
One week course on viscosity solutions

2018, '20 Mentor, University of Chicago Directed Reading Program
Supervised one undergraduate in '18 and one in '20

2017—2018 Tutor, Strive Program, Chicago, IL
One-on-one tutoring with a local highschool student

## Service

### Refereeing

Refereed for or offered opinions to the following journals:

*Ann. Appl. Probab.*, *Ann. Inst. H. Poincaré Anal. Non Linéaire*, *Electron. Commun. Probab.*, *SIAM J. Control Optim.*

### University of Chicago

2018—2021 Student organizer, Prospective Student Weekend
Coordinated activities for prospective math PhD students

2018—2019 Graduate student ombudsperson