

CURRICULUM VITAE

SIMING HE

CONTACT INFORMATION

218 Physics Building
120 Science Drive
Department of Mathematics
Duke University
Durham, NC, 27708

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AREAS OF INTERESTS

Analysis, Applied Mathematics, Partial Differential Equations
Particular interests: Chemotaxis; Flocking Hydrodynamics; Small Scale
Creation and Hydrodynamic Stability in Mathematical Fluid Mechanics

EMPLOYMENT

08/2018-07/2022 William W. Elliott Assistant Research Professor
Department of Mathematics
Duke University
Durham, NC
Mentor: Alexander Kiselev

EDUCATION

2012-2018 Ph.D., University of Maryland, College Park
Department of Mathematics
Center for Scientific Computation and Mathematical Modeling (CSCAMM)
College Park, MD
Advisor: Eitan Tadmor

10/2016-6/2017 ETH
Institute for Theoretical Studies
Zürich, Switzerland
Advisor: Eitan Tadmor

2008-2012 B.A., Zhejiang University
Hangzhou, China
Major: Mathematics and Applied Mathematicse
Thesis Advisor: Hongwei Xu

08/2011–12/2011	Exchange to Indiana University, Bloomington Bloomington, IN Major: Mathematics
2005–2008	Guangdong Experimental Middle School, Guangzhou, China

PUBLICATIONS

- *Suppression of chemotactic blow-ups through time-dependent shear flows*, with Tarek Elgindi, in preparation;
- *Stirring speeds up chemical reaction*, with Alexander Kiselev, arXiv:2107.13134;
- *Random search in fluid flow aided by chemotaxis*, with Yishu Gong, Alexander Kiselev, arXiv:2107.02913;
- *On the Fast Spreading Scenario*, with Eitan Tadmor, Andrej Zlatoš, arXiv:2104.00701;
- *Enhanced dissipation, hypoellipticity for passive scalar equations with fractional dissipation*, arXiv:2103.07906;
- *Boundary layer models of the Hou-Luo scenario*, with Alexander Kiselev, Journal of Differential Equations, 298, 182–204, 2021;
- *Inviscid damping and enhanced dissipation of the boundary layer for 2D Navier-Stokes linearized around Couette flow in a channel*, with Jacob Bedrossian, Communications in Mathematical Physics, 379 (1), 177–226, 2020;
- *A game of alignment: collective behavior of multi-species*, with Eitan Tadmor, Annales de l'Institut Henri Poincaré C, Analyse Non Linéaire, 38 (4), 1031–1053, 2021;
- *Small scale creation for solutions of the SQG equation*, with Alexander Kiselev, Duke Mathematical Journal, 170 (5), 1027–1041, 2021;
- *On the 8π -critical mass threshold of a Patlak-Keller-Segel-Navier-Stokes system*, with Yishu Gong, SIAM J. Math. Anal., 53 (3), 2925–2956, 2021;
- *Multi-species Patlak-Keller-Segel system*, with Eitan Tadmor, Indiana University Mathematics Journal, 70 (4), 1577–1624, 2021;
- *Suppression of blow-up in Parabolic-Parabolic Patlak-Keller-Segel via strictly monotone shear flows*, Nonlinearity, 31 (8), 3651–3688, 2018;
- *Suppressing chemotactic blow-up through a fast splitting scenario on the plane*, with Eitan Tadmor, Arch. Ration. Mech. Anal., 232 (2), 951–986, 2019;
- *Suppression of blow-up in Patlak-Keller-Segel via shear flows*, with Jacob Bedrossian, SIAM J. Math. Anal., 49 (6), 4722–4766, 2017; *Erratum: Suppression of blow-up in Patlak-Keller-Segel via shear flows*, SIAM J. Math. Anal., 50 (6), 6365–6372, 2018;

- *Global regularity of two-dimensional flocking hydrodynamics*, with Eitan Tadmor, *Comptes Rendus Mathematique*, 355 (7), 795-805, July 2017;
- *Distance comparison principle and Grayson type theorem in the three-dimensional curve shortening flow*, arXiv:1209.5146, 2012.

GRANT

NSF DMS-2006660, "Topics in Mathematical Biology and Fluid Mechanics" (PI).

UNDERGRADUATE RESEARCH

05/2020-07/2020 Domath Project (with Alexander Kiselev): PDE modeling of collective motion
 Paper: "*Hitting time of Brownian motion subject to shear flow*", with Despina Chouliara, Yishu Gong, Alexander Kiselev, James Lim, Omar Melikechi, Keenan Powers

HONORS AND AWARDS

06/2012 Rank Top 3% in Department of Mathematics, Zhejiang University
 06/2012 Excellent undergraduate thesis award of Zhejiang University, Zhejiang University
 09/2012-08/2014 Dean's Fellowship, University of Maryland, College Park
 05/2015 2014-2015 Aziz/Osborn Gold Medal in Teaching Excellence Award
 08/2015-12/2015 Patrick and Marguerite Sung Fellowship
 01/2016-05/2016 Research Assistantship: ONR Grant
 09/2016-12/2016 Ann G. Wylie Dissertation Fellowship

TALKS

02/2017 Poster talk, ICERM Workshops: Dynamics of Small Scales in Fluids, Brown University, Providence, RI
 09/2017 Special Session on Nonlocal PDEs in Fluid Dynamics, AMS Fall Central Sectional Meeting, University of North Texas, Denton, TX
 10/2017 KI-Net Young Researchers Workshop: Current trends in kinetic theory, University of Maryland, College Park, MD

10/2018	Young Researchers Workshop: Ki-Net, University of Maryland, College Park
03/2019	Applied Math and Analysis Seminar, Duke University
05/2019	Real Analysis Seminar, Department of Mathematics, UCSD
09/2019	Formation of small scales in nonlinear PDEs, Center for Scientific Computation & Math. Modeling, University of Maryland, College Park
10/2019	Young Researchers Workshop: Ki-Net 2012-2019, Center for Scientific Computation & Math. Modeling, University of Maryland, College Park
10/2020	AMS Eastern Sectional Meeting, Special Session on Turbulence and Mixing in Fluid Dynamics, Online
10/2020	PDE seminar, University of Minnesota, Twin Cities, Online

CONFERENCES AND SUMMER SCHOOLS

06/2013–07/2013	The 23rd Annual PCMI Summer Session: Geometric Analysis Park City, Utah
07/2013–08/2013	2013 PI Summer Graduate Program: Flow, Geometric Motion, Deformation, and Mass Transport in Physiological Processes University of Minnesota, Minneapolis, MN
07/2014	Chicago Summer School in Analysis, University of Chicago, IL
07/2014	NSF-CBMS Regional Research Conference in the Mathematical Sciences: Problems of PDEs Related to Fluids, Oklahoma State University, Stillwater, OK
10/2014	Young Researchers Workshop: Multiscale phenomena: modeling, analysis and computation, University of Maryland, College Park, MD
07/2015–08/2015	Summer School: Incompressible Fluid Flows at High Reynolds Number, The Mathematical Sciences Research Institute, Berkeley, CA
10/2015	Analysis of PDEs of Fluid Mechanics and Related Models Mini-School and Workshop, Rice University, Houston, TX
11/2015	Fifth Abel Conference: Celebrating the Mathematical Impact of John F. Nash Jr. and Louis Nirenberg, University of Minnesota, Minneapolis, MN

05/2016	Analysis of PDEs of Fluid Mechanics, Rice University, Houston, TX
06/2016	Harmonic Analysis and Elliptic Equations on real Euclidean Spaces and on Rough Sets, The Mathematical Sciences Research Institute, Berkeley, CA
01/2017	ICERM Workshops Current Developments in Mathematical Fluid Dynamics: Regularity, Instabilities, and Turbulence, Brown University, Providence, RI
02/2017	ICERM Workshops: Dynamics of Small Scales in Fluids, Brown University, Providence, RI
10/2018	Young Researchers Workshop: Ki-Net University of Maryland, College Park
09/2019	Formation of small scales in nonlinear PDEs Center for Scientific Computation & Math. Modeling, University of Maryland, College Park
10/2019	Young Researchers Workshop: Ki-Net 2012-2019, Center for Scientific Computation & Math. Modeling, University of Maryland, College Park
10/2020	AMS Eastern Sectional Meeting, Special Session on Turbu- lence and Mixing in Fluid Dynamics, Online

TEACHING

09/2012–12/2012	Teaching Assistant for Math 112: College Algebra
02/2013–05/2014	Teaching Assistant for Math 141: Calculus II
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09/2013–12/2013	Teaching Assistant for Math 141: Calculus II
02/2014–05/2014	Teaching Assistant for Math 141: Calculus II
09/2014–12/2014	Teaching Assistant for Math 241: Calculus III
02/2015–05/2015	Teaching Assistant for Math 240: Introduction to Linear Algebra
02/2017–06/2017	Grader for Math 660 (Complex Analysis I) and Math 674 (Partial Differential Equations II)
09/2018–12/2018	Math 230: Probability
01/2019–06/2019	Math 353: ODE & PDE
09/2019–12/2019	Math 353: ODE & PDE

01/2020-06/2020 Math 212: Multivariable Calculus
09/2020-12/2020 Math 353: ODE & PDE
01/2021-05/2020 Math 353: ODE & PDE
09/2021-12/2021 Math 353: ODE & PDE

PROFESSIONAL SERVICE

Journal refereeing:

SIAM Journal of Mathematical Analysis, Communication in Mathematical Physics, Transaction of the American Mathematical Society, Analysis and PDE, Communications in Mathematical Sciences, Nonlinearity, Journal of Nonlinear Science.

SKILLS

Language: English, Chinese, Cantonese

Computer: Matlab, C/C++, Latex