Paul Carter

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Research interests

Dynamical systems, nonlinear waves, pattern formation, singular perturbations, partial differential equations, applied mathematics

Professional appointments

2025 – present	Associate Professor, University of California, Irvine, CA
2021 – 2025	Assistant Professor, University of California, Irvine, CA
2019 – 2021	Assistant Professor, University of Minnesota, Minneapolis, MN
2016 – 2019	Postdoctoral Research Associate, University of Arizona, Tucson, AZ
2017 – 2018	Postdoctoral Researcher, Leiden University, Leiden, NL

Education

2011 – 2016	Brown University, Providence, RI
	PhD, Mathematics, 2016, advisor: Björn Sandstede
	Thesis: *Fast pulses with oscillatory tails in the FitzHugh–Nagumo system*
	ScM, Mathematics, 2013
2010 – 2011	Magdalene College, University of Cambridge, Cambridge, UK
	MASt, Applied Mathematics and Theoretical Physics (Distinction), 2011
2007 – 2010	Mansfield College, University of Oxford, Oxford, UK
	BA, Mathematics (First), 2010

Grants & Awards

2023 – 2028	PI: NSF CAREER DMS-2238127 ($496,663)
	"Pattern formation in singularly perturbed partial differential equations"
2021 – 2025	PI: NSF DMS-2105816 ($237,885)
	"Self-organization, stability, and defects in pattern-forming systems"
2018 – 2023	PI: NSF DMS-2204758 (formerly DMS-2016216, DMS-1815315) ($117,956)
	"Patterns and bifurcations in multiple timescale dynamical systems"
2020 – 2021	PI/Faculty Sponsor: MAA Tensor Women in Mathematics Grant ($12,000)
	"Mathematics Project at Minnesota"
2016 – 2018	AMS Simons Travel Grant ($4,000)
2015 – 2016	SIAM/AMS Student Travel Awards (various)
2014	Brown University Doctoral Research Travel Grant ($1,688)
2014	SIAM NWCS14 Conference "best poster" prize.
2008 – 2009	Scholarship & Exhibition Prizes, University of Oxford

Peer-reviewed journal articles

- S Banerjee, M Baudena, P Carter, R Bastiaansen, A Doelman, and M Rietkerk. Rethinking tipping points in spatial ecosystems. *The American Naturalist* (accepted).

- M Avery, P Carter, B de Rijk, and A Scheel. Stability of coherent pattern formation through invasion in the FitzHugh–Nagumo system. *Journal of the European Mathematical Society* (2025), published online first.

- P Carter, A Doelman, P van Heijster, D Levy, P Maini, E Okey, P Yeung. Deformations of acid-mediated invasive tumors in a model with Allee effect. *Journal of Mathematical Biology* 90(55) (2025).

- P Carter, A Doelman, A Iuorio, F Veerman. Travelling pulses on three spatial scales in a Klausmeier-type vegetation-autotoxicity model. *Nonlinearity* 37(9) (2024), 095008.

- P Carter. A stabilizing effect of advection on planar interfaces in singularly perturbed reaction diffusion equations. *SIAM Journal on Applied Mathematics* 84(3) (2024), pp. 1227-1253.

- E Byrnes, P Carter, A Doelman, and L Liu. Large amplitude radially symmetric spots and gaps in a dryland ecosystem model. *Journal of Nonlinear Science* 33(107) (2023).

- P Carter, K Lilly, E Obermayer, S Rao, and A Doelman. Criteria for the (in)stability of planar interfaces in singularly perturbed 2-component reaction-diffusion equations. *Physica D* 444 (2023), 133596.

- T Chin, J Ruth, C Sanford, R Santorella, P Carter, and B Sandstede. Enabling equation-free modeling via diffusion maps. *Journal of Dynamics and Differential Equations* 36 (2024), pp. 415-434.

- P Carter and A Champneys. Wiggly canards: growth of traveling wave trains through a family of fast-subsystem foci. *Discrete and Continuous Dynamical Systems - S* 15(9) (2022), pp. 2433-2466.

- P Carter, J Rademacher, and B Sandstede. Pulse replication and accumulation of eigenvalues. *SIAM Journal on Mathematical Analysis* 53(3) (2021), pp. 3520-3576.

- A Bauer and P Carter. Existence of transonic solutions in the stellar wind problem with viscosity and heat conduction. *SIAM Journal on Applied Dynamical Systems* 20(1) (2021), pp. 262-298.

- P Carter. Spike-adding canard explosion of bursting oscillations. *Journal of Nonlinear Science* 30(6) (2020), pp. 2613-2669.

- T Aougab, M Beck, P Carter, S Desai, B Sandstede, M Stadt, and A Wheeler. Isolas versus snaking of localized rolls. *Journal of Dynamics and Differential Equations* 31(3) (2019), pp. 1199-1222.

- J Bramburger, D Altschuler, C Avery, T Sangsawang, M Beck, P Carter, and B Sandstede. Localized radial roll patterns in higher space dimensions. *SIAM Journal on Applied Dynamical Systems* 18(3) (2019), pp. 1420-1453.

- R Bastiaansen, P Carter, and A Doelman. Stable planar vegetation stripe patterns on sloped terrain in dryland ecosystems. *Nonlinearity* 32(8) (2019), pp. 2759-2814.

- P Carter and A Doelman. Traveling vegetation stripes in the Klausmeier model. *SIAM Journal on Applied Mathematics* 78(6) (2018), pp. 3213-3237.

- P Carter and A Scheel. Wave train selection by invasion fronts in the FitzHugh–Nagumo equation. *Nonlinearity* 31(12) (2018), pp. 5536-5572.

- P Carter and B Sandstede. Unpeeling a homoclinic banana in the FitzHugh–Nagumo system. *SIAM Journal on Applied Dynamical Systems* 17(1) (2018), pp. 236-349.

- C Xia, C Cochrane, J DeGuire, G Fan, E Holmes, M McGuirl, P Murphy, J Palmer, P Carter, L Slivinski, and B Sandstede. Assimilating Eulerian and Lagrangian data in traffic-flow models. *Physica D* 346 (2017), pp. 59-72.

- P Carter, E Knobloch, and M Wechselberger. Transonic canards and stellar wind. *Nonlinearity* 30(3) (2017), pp. 1006-1033.

- P Carter, B de Rijk, and B Sandstede. Stability of traveling pulses with oscillatory tails in the FitzHugh–Nagumo system. *Journal of Nonlinear Science* 26(5) (2016), pp. 1369-1444.

- P Carter and B Sandstede. Fast pulses with oscillatory tails in the FitzHugh–Nagumo system. *SIAM Journal on Mathematical Analysis* 47(5) (2015), pp. 3393-3441.

- P Carter, PL Christiansen, YB Gaididei, C Gorria, B Sandstede, MP Sorensen, and J Starke. Multi-jam solutions in traffic models with velocity-dependent driver strategies. *SIAM Journal on Applied Mathematics* 74(6) (2014), pp. 1895-1918.

Conference proceedings/reports

C1. P Carter. Pulse replication and slow absolute spectrum in the FitzHugh-Nagumo system. *Oberwolfach Reports* 37 (2021), pp. 45-48.

Expository publications

E2. P Carter and D Lowry-Duda. On functions whose mean value abscissas are midpoints. *The American Mathematical Monthly* 124(6) (2017), 535-542.

E1. P Carter and Y Solomon. Relaxing the integral test: An "elementary" challenge for the advanced calculus student. *College Mathematics Journal* 48(4) (2017), 290-291.

Invited talks

2025	SIAM Conference on Applications of Dynamical Systems, Denver, CO.
2025	Dynamical Systems Seminar, Leiden University, Leiden, NL
2025	Applied and Computational Math Seminar, George Mason University, Fairfax, VA.
2025	Applied Math / PDE / Data Science Seminar, UC Santa Barbara, CA.
2024	Multiple Scales: Theory and Application, Lorentz Center, Leiden, NL.
2024	SIAM Conference on Nonlinear Waves and Coherent Structures, Baltimore, MD.
2024	Equadiff, Karlstad, Sweden.
2024	Dynamics Seminar, Ohio University, Athens, OH.
2024	UCI Systems Biology Retreat, Pasadena, CA.
2023	Patterns and Waves in Niseko, Niseko, JP.
2023	ICIAM 2023, Waseda University, Tokyo, JP.
2023	NDNS+ Annual Workshop, Universiteit Twente, Enschede, NL.
2023	SIAM Conference on Applications of Dynamical Systems, Portland, OR
2023	PDE Seminar, UH, Houston, TX
2023	Symposium on Fronts, Patterns, and Self-Organization, UMN, Minneapolis, MN
2022	BIRS Workshop on "Topics in Multiple Time Scale Dynamics", Banff, CA.
2022	SIAM Conference on Nonlinear Waves and Coherent Structures, Bremen, DE.
2022	Wave Phenomena Seminar, Karlsruhe Institute of Technology, Karlsruhe, DE.
2022	Dynamical Systems Seminar, Leiden University, Leiden, NL
2021	UCI Dynamical Systems Seminar, Irvine, CA
2021	MFO workshop on Dynamics of Waves and Patterns, Oberwolfach, DE.
2021	SIAM Conference on Applications of Dynamical Systems (virtual).
2020	Analysis, Dynamics, and Applications Seminar, University of Arizona, Tucson, AZ.
2020	Colloquium, UC Irvine, Irvine, CA.
2020	Dynamical Systems Seminar, BU, Boston, MA

2019	Equadiff, Leiden, NL.
2019	SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
2019	Colloquium, NC State University, Raleigh, NC.
2019	Applied Math Seminar, UC Irvine, Irvine, CA.
2018	Climate Seminar, UMN, Minneapolis, MN.
2018	Oliver Club, Cornell University, Ithaca, NY.
2018	Analysis and Applied Math Seminar, University of Toronto, Toronto, ON.
2018	SIAM Annual Meeting, Portland, OR.
2018	NDNS+ Annual Workshop, Universiteit Twente, Enschede, NL.
2018	SIAM Conference on Nonlinear Waves and Coherent Structures, Orange, CA.
2018	Dynamical Systems Seminar, UMN, Minneapolis, MN.
2018	Oberseminar Dynamics, Munich, Germany.
2018	Oberseminar Analysis and Modelling, Stuttgart, Germany.
2018	Applied Analysis Seminar, Bremen, Germany.
2017	Applied Analysis Seminar, Bremen, Germany.
2017	Equadiff, Bratislava, Slovakia.
2017	The Future of Singular Perturbations, Lorentz Center, Leiden, NL.
2017	Analysis Lunch Seminar, Leiden University, Leiden, NL.
2017	Mathematics of Climate Seminar, UMN, Minneapolis, MN.
2017	Dynamical Systems Seminar, UMN, Minneapolis, MN.
2017	IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA
2016	SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA
2016	AIMS Conference on Dynamical Systems, Differential Eqs, and Applications, Orlando, FL
2015	SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
2015	Applied and Computational Math Seminar, GMU, Fairfax, VA.
2015	AMS Central Spring Sectional Meeting, MSU, East Lansing, MI.
2014	Brown/BU PDE seminar, Brown University, Providence, RI.

Contributed talks & poster presentations

2020	Applied Math COVID-19 Working Group, University of Arizona, Tucson, AZ.
2020	Mathematics of Climate Seminar, UMN, Minneapolis, MN.
2018	Analysis, Dynamics, and Applications Seminar, University of Arizona, Tucson, AZ.
2017	Analysis, Dynamics, and Applications Seminar, University of Arizona, Tucson, AZ.
2017	SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
2017	Analysis, Dynamics, and Applications Seminar, University of Arizona, Tucson, AZ.
2016	Uncertainty Quantification Group Seminar, University of Arizona, Tucson, AZ.
2016	Analysis, Dynamics, and Applications Seminar, University of Arizona, Tucson, AZ.
2016	Analysis of PDEs using Dynamical Systems Techniques, Boston, MA [Poster]
2015	Equadiff, Lyon, France
2014	SIAM Conference on Nonlinear Waves and Coherent Structures, Cambridge, UK. [Poster]
2014	SDG workshop "Multiscale problems arising in the biosciences", Blackheath, NSW. [Poster]
2014	Brown Informal PDE seminar, Brown University, Providence, RI.
2012	Brown Informal PDE seminar, Brown University, Providence, RI.
2012	Brown Informal PDE seminar, Brown University, Providence, RI.

Research visits

2023	Collaborate@ICERM: "Stability of pattern-forming fronts in the FitzHugh-Nagumo system" Institute for Computational and Experimental Research in Mathematics, Providence, RI.

Workshop participation

2016   KUMU Conference on PDE, Dynamical Systems, and Applications, MU, Columbia, MO.
2014   IMA workshop on "Algebraic topology in dynamics and data", Minneapolis, MN.
2013   DTU winter school "Multi-scale analysis in dynamical systems", Copenhagen, Denmark.

Teaching

- University of California, Irvine

Fall 2022–2025	Math 290A: Methods of Applied Mathematics I
Winter 2025	Math 295B: Partial Differential Equations II
Fall 2024	Math 295A: Partial Differential Equations I
Winter 2024	Math 117: Dynamical Systems
Winter 2023	Math 112B: Intro to PDEs and Applications II
Winter 2022	Math 290B: Methods of Applied Mathematics II
Winter 2022	Math 3A: Introduction to Linear Algebra
Fall 2021	Math 112A: Intro to PDEs and Applications I

- University of Minnesota

Fall 2020	Math 8501: Differential Equations and Dynamical Systems
Fall 2019, Fall 2020	Math 2374: CSE Multivariable Calculus and Vector Analysis

- University of Arizona

Spring 2019	Math 456/556: Applied Partial Differential Equations
Fall 2018	Math 454: ODEs and Stability Theory
Spring 2017	Math 355: Analysis of Ordinary Differential Equations
Fall 2016, Fall 2018	Math 125: Calculus I

- Brown University

Fall 2014	MA0200: Intermediate calculus (physics/engineering) (Instructor)
Spring 2013	MA0180: Intermediate calculus (TA)
Fall 2012	MA0100: Introduction to calculus II (TA)

- Summer@Brown

Summer 2013, 2014, 2015	CEMA0904: How big is infinity? (Instructor)
Summer 2013, 2014, 2015	CEMA0908: Fundamentals for calculus (Instructor)

Mentoring & Advising

- PhD Students

Jaaziel De La Luz	2024 – present
Clara Park	2024 – present
Daniel Shvartsman	2023 – present

- Graduate advising and research

Michelle Mastrianni	Spring 2020	Independent study, UMN

- Graduate committees

Cristian Meraz	Spring 2025	PhD Defense Committee, U Houston
Rebecca Gu	Winter 2025	PhD Advancement Committee, UCI
Samuel Lopez	Fall 2024	PhD Defense Committee, UCI
Alice Vo	Fall 2024	Master's Thesis Committee, UCI

Erik Bergland	Summer 2024	PhD Defense Committee, Brown University
Alice Vo	Spring 2024	PhD Advancement Committee, UCI
Grigorii Monakov	Spring 2024	PhD Advancement Committee, UCI
Rachel D'Souza	Fall 2023	PhD Advancement Committee, UCI
Alex Luna	Spring 2023	PhD Advancement Committee, UCI
Grace Zhang	Spring 2022	PhD Oral Preliminary Exam Committee, UMN
Matthew Hirning	Winter 2022	PhD Advancement Committee, UCI
Eleonora Mosesov	Summer 2021	Master's Final Exam Committee, UMN
Olivia Cannon	Fall 2020	PhD Oral Preliminary Exam Committee, UMN
Montie Avery	Spring 2020	PhD Oral Preliminary Exam Committee, UMN
Tianyu Tao	Spring 2020	PhD Final Oral Exam Committee, UMN

- Undergraduate advising and research

Jennifer Shim	Summer 2023 – present, NSF REU and senior thesis, UCI/Brown
Sijia Zhang	Fall 2023 – present, NSF REU and supervised research (199), UCI
Andrew Gusty	Summer 2025, NSF REU
Yu Feng	Spring 2024 – 2025, NSF REU and supervised research (199), UCI
Daniel Levy	Summer 2023, NSF REU, UCI/Leiden
Erin Okey	Summer 2023, NSF REU, UCI/Leiden
Paige Yeung	Summer 2023, NSF REU, UCI/Leiden
Guogen Lan	Summer 2022, NSF REU, UCI
Kaitlynn Lilly	Summer 2021, NSF REU (virtual)
Erin Obermayer	Summer 2021, NSF REU (virtual)
Shreyas Rao	Summer 2021, NSF REU (virtual)
Zeyu Li	Fall 2020, Independent study/senior project, UMN
Ellie Byrnes	Summer 2020, NSF REU (virtual)
Lily Liu	Summer 2020, NSF REU (virtual)
Stephen Ingraham	Spring 2020, Independent study/senior project, UMN
Adam Bauer	Spring/Summer 2019, NSF REU and Independent study, UArizona
Parker Liu	Spring 2019, Independent study/directed research, UArizona

- Mentoring and outreach activities

2021 – present	UC Irvine Math Circle
2016 – 2017, 2018 – 2019	Tucson Math Circle, University of Arizona
Spring 2017, Fall 2018	Mentor for UArizona Undergraduate TA Program
	Students advised: Erika Leatherwood, Kevin Milligan
Summer 2016	Postdoc TA/mentor for the Summer@ICERM REU program
	Students advised: Dylan Altschuler, Chloe Avery, Tracy Chin
	Surabhi Desai, Jacob Ruth, Therathep Sangsawang
	Rebecca Santorella, Melissa Stadt, Aric Wheeler

Editorial and reviewing activities

- Physica D. Early Career Editorial Board member (2022 – present)

- Discrete and Continuous Dynamical Systems - S. Guest editor for special issue on "Advances in the mathematical study of pattern formation," September 2022.

- Referee/reviewer: Applied Mathematical Modeling, Archive for Rational Mechanics and Analysis, Communications in Nonlinear Science and Numerical Simulation, Discrete and

Continuous Dynamical Systems, European Journal of Applied Mathematics, IMA Journal of Applied Mathematics, Indiana University Mathematics Journal, International Journal of Bifurcation and Chaos, Journal of Differential Equations, Journal of Dynamics and Differential Equations, Journal of Mathematical Biology, Journal of Nonlinear Science, Mathematical Biosciences, Mathematical Reviews, Multiscale Modeling and Simulation, Nonlinear Differential Equations and Applications, Nonlinearity, Physica D, Reports on Mathematical Physics, SIAM Journal on Applied Dynamical Systems, SIAM Journal on Applied Mathematics, SIAM Journal on Mathematical Analysis, SIAM Review, Studies in Applied Mathematics, Zeitschrift fuer Angewandte Mathematik und Physik

Professional development

- Division of Teaching Excellence and Innovation, University of California, Irvine

  Winter 2023 – Active Learning Institute

- Office of Inclusive Excellence, University of California, Irvine

  2022 – Inclusive Excellence Certificate Program

- Office for Equity and Diversity Education, University of Minnesota

  2021 – Equity and Diversity Certificate

- Office for Diversity and Inclusive Excellence, University of Arizona

  2018 – Leader in Classroom Diversity & Inclusion Certificate

- Eller College of Management, University of Arizona

  2018 – Tomorrow's Leaders Equipped for Diversity Certificate

- Sheridan Center for Teaching and Learning

2013 – 2016	Sheridan Center teaching consultant
Fall 2015	New TA orientation workshop leader
2013 – 2015	Sheridan Center Certificate IV
2013 – 2014	Sheridan Center Certificate I workshop discussion leader
2012 – 2013	Sheridan Center Certificate I

Service and Committees

2025 – present	Graduate Studies Committee, UCI
2025 – present	BA in Mathematics Task Force, UCI
2024 – present	Faculty Sponsor for the Undergraduate Mathematics Committee, UCI
2023 – present	Applied Mathematics Qualifying Exam Committee, UCI
2021 – present	Excellence Committee, Department of Mathematics, UCI
2023 – 2024	Awards Committee, Department of Mathematics, UCI
2024, 2025	Judge, Integration Bee, UCI
2022 – 2023	Graduate Admissions Committee, Department of Mathematics, UCI
2021 – 2022	Awards Committee, Department of Mathematics, UCI
2022	Panel Member, Postdoc Career Panel, UCI.
2020 – 2021	Faculty Sponsor for "Mathematics Project at Minnesota" Workshop
2020 – 2021	Dunham Jackson Postdoc Search Committee, School of Mathematics, UMN
2019 – 2021	Instructional Evaluation Committee, School of Mathematics, UMN
2019 – 2020	Graduate Committee, School of Mathematics, UMN
2016	Panel Member, Brown SIAM Student Chapter Math Postdoc Panel.

2016	Judge, Brown Math Modeling Competition, Providence, RI
2015	Organizer, Brown University Math Postdoc panel.
2009 – 2010	Mansfield College Rep. for the Maths Undergraduate Rep. Committee

Organizing

- Conferences/workshops

2025	Co-organizer of Mathematics of Data, Dynamics, and Life Sciences Conference NSF-Simons Center for Multiscale Cell Fate, UC Irvine, CA
2025	Co-organizer of Patterns, Dynamics, and Data in Complex Systems Workshop ICERM, Providence, RI

- Seminars

2021 – present	Co-organizer, Applied and Computational Mathematics Seminar, UC Irvine
2020 – 2021	Co-organizer, Dynamical Systems Seminar, University of Minnesota

- Conference minisymposia

2025	Co-organizer of minisymposium "The Dynamics of Tissue Growth and Invasive Tumors" SIAM Conference on Applications of Dynamical Systems, Denver, CO
2024	Co-organizer of minisymposium "Pattern formation in biological applications" SIAM Conference on Nonlinear Waves and Coherent Structures, Baltimore, MD
2024	Co-organizer of minisymposium "Singularly perturbed systems" Equadiff 2024, Karlstad, Sweden
2022	Co-organizer of minisymposium "Planar and Higher-Dimensional Patterns: Analysis & Numerics" SIAM Conference on Nonlinear Waves and Coherent Structures, Bremen, DE
2021	Co-organizer of minisymposium "Wave & front dynamics: propagation & stability" SIAM Conference on Applications of Dynamical Systems (Virtual)
2019	Co-organizer of minisymposium "Traveling Waves: Selection Principles and Stability" SIAM Conference on Analysis of PDEs, La Quinta, CA
2018	Co-organizer of minisymposium "Defects and Inhomogeneities in Pattern Forming Systems" SIAM Annual Meeting, Portland, OR
2017	Co-organizer of minisymposium "Nonlocal Behavior in Biological Applications" SIAM Conference on Applications of Dynamical Systems, Snowbird, UT
2016	Co-organizer of minisymposium "Geometric approaches to traveling waves in PDE models" SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA
2015	Co-organizer of minisymposium "The behavior of autonomous agents in diverse applications" SIAM Conference on Applications of Dynamical Systems, Snowbird, UT

- Department events

2023 – 2025	Organizing team and faculty participant, Coffee with Math Professors, UCI
2023, 2024	Co-organizer of Undergraduate Math Course Planning Workshop, UCI
2023, 2024	Co-organizer of Math Industry and Career panel, UCI
2023	Co-organizer of Mathematics Junior Faculty Mentoring Event, UCI