

# Jörn Dunkel

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## Employment:

MathWorks Professor of Mathematics, MIT, 07/2023–  
Professor, Applied Mathematics, MIT, 07/2022–  
Associate professor with tenure, Applied Mathematics, MIT, 07/2020-06/2022  
Associate professor, Applied Mathematics, MIT, 07/2018–06/2020  
Assistant professor, Applied Mathematics, MIT, 09/2013–06/2018  
Postdoctoral research associate, DAMTP, University of Cambridge, 09/2010-08/2013  
Postdoctoral research assistant, Rudolf Peierls Centre, University of Oxford, 09/2008-08/2010

## Degrees:

Dr. rer. nat. (Ph.D.), Physics, University of Augsburg, 2008, Advisor: Peter Hänggi  
Mathematics diploma (M.Math.), Humboldt-Universität zu Berlin, 2005  
Physics diploma (M.Phys.), Humboldt-Universität zu Berlin, 2004

## Honors:

Fellow of the American Physical Society, 2025  
Schmidt Science Polymath Award, Schmidt Futures, 2023  
Robert E. Collins Distinguished Scholar, MIT Mathematics Department, 2020-2023  
Gallery of Fluid Motion Award<sup>1</sup>, APS/DFD, 2017  
Outstanding Referee, American Physical Society, 2017  
Complex Systems Scholar Award, James S. McDonnell Foundation, 2016–2022  
Alfred P. Sloan Research Fellowship, 2015–2017  
Edmund F. Kelly Research Award, MIT Mathematics Department, 2015-2018  
Research Fellow, Murray Edwards College, University of Cambridge, 2011–2013  
Gustav Hertz Prize, German Physical Society (DPG), 2011  
Junior Research Fellow, Mansfield College, University of Oxford, 2008–2010  
Erich Krautz Prize, Universität Augsburg, 2008  
SCOR Actuarial Award, SCOR Group & Universität Ulm, 2005  
Humboldt Prize, Humboldt-Universität zu Berlin, 2004  
Lise Meitner Prize, Institute for Physics, Humboldt-Universität zu Berlin, 2004  
Scholarship, German National Academic Foundation (Studienstiftung), 2001–2003

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<sup>1</sup>with Pedro Saenz, Giuseppe Pucci, Alexis Goujon, Tudor Cristea-Platon, John Bush

UROP/SPUR Students Supervised:

Rothbaum, Adam (SB Math & Physics, Class '26). Winter 2025–Spring 2025  
Finlay, Mikaela (SB Math & CS, Class '26). Summer 2024–Spring 2025  
Mikulevica, Anna (SB Math, Class '25). Fall 2023–Spring 2024  
Liu, Elaine (SB Math & EECS major, Class '24). Summer 2023–Fall 2023  
Next position: PhD Student, Stanford University  
Miner, Katherine (SB Math, Class '24). Fall 2022–Spring 2024  
Next position: PhD Student, University of Chicago  
Brattley, Allison (SB Physics major, Class '24). Summer 2022–Spring 2024  
Next position: MD-PhD Candidate, Yale School of Medicine  
Goel, Gopal (SB Math major, Class '25). Summer 2022–Spring 2023  
Ji, Catherine (SB Math '23). Fall 2019–Fall 2021  
Next position: PhD Student, Princeton University  
Garcia Andrade, Agustin (SB Math '21). Spring 2021  
Next position: Algorithm Developer, Hudson River Trading  
Srinisivan, Anand (SB Math '21). Summer 2020–Fall 2020  
Next position: PhD Student, Cambridge University  
Naveen, Venkaat (SB Math major, class of '23). Summer 2020  
Shin, Tristan (SB Math & Music major, class of '23). Summer 2020  
Li, Jovita (SB Math major, class of '23). Spring 2020  
Reilly, Sonia (SB Math & CS '21). Fall 2019–Spring 2021  
Next position: PhD Student, Courant Institute of Mathematical Sciences  
Allen, Keita (SB Math major, Class '23). Fall 2019–Spring 2020  
Moseley, Fischer (SB Physics major, Class '21). Fall 2018–Spring 2020  
Next position: Electrical Engineer, Electric Era  
Yu, Josephine (SB Physics '20). Spring 2018–Fall 2018  
Next position: PhD Student, Applied Physics, Stanford University  
Hastewell, Alasdair (SB Physics '18). Fall 2016–Spring 2018  
Next position: PhD Student, MIT Mathematics  
Heisser, Ronald H. (SB MechE '16). Fall 2015–Spring 2016  
Next position: PhD Student, School of Mechanical and Aerospace Engineering, Cornell University  
Runnels, Wesley (SB Math '18, MEng CS '20). Summer 2015  
Next position: Software Engineer, Einblick  
Kavle, Henry (SB Math '17). Summer 2015  
Next position: PhD Student, Department of Applied Mathematics, University of Washington  
Shin, Dong-Gil (Math major, Class '19). Fall 2014–Spring 2015  
Vachharajani, Vipul (SB Math & BE '16). Fall 2014–Spring 2015  
Next position: MD-PhD Student, Stanford Medical School

SB Students Senior Thesis Supervised:

Hastewell, Alasdair.

*Influence of Gene Expression Gradients on Positional Information Content in Fly Embryos.*

MIT Physics, 2018

Next position: PhD Student, MIT Math

Jeckel, Hannah.

*Mathematical Modeling of Bacterial Swarming.*

Visiting MSc Student from Philipps University of Marburg, 2017

Next position: PhD Student, Max-Planck Institute for Terrestrial Microbiology

Heisser, Ronald.

*Design, Development, and Characterization of an Experimental Device to Test Torsion-Controlled Fracture of Thin Brittle Rods.* MIT MechE, 2016

Next position: PhD Student, School of Mechanical and Aerospace Engineering, Cornell University

PhD Students Thesis Supervised:

Huang, Rosalind.

*In progress*, MIT Physics, since 2022

Walden, Harry.

*In progress*, MIT Math, since 2024

Harry was awarded a MathWorks Science Fellowship, 2024-2025.

Zhang, Shijie.

*In progress*, MIT CSE-Math, since 2022

Reyes, Jorge.

*In progress*, MIT Computational & Systems Biology, since 2022

Jorge was awarded a MathWorks Science Fellowship, MIT School of Science, 2022-2023

He was awarded an NSF Graduate Research Fellowship, 2023-.

Cohen, Alexander (jointly with Martin Bazant).

*In progress*, MIT ChemE, since 2021

Alex was awarded an NDSEG Fellowship, 2022-2025.

Stepaniants, George (jointly with Philippe Rigollet).

*Inference from Limited Observations in Statistical, Dynamical, and Functional Problems*, MIT Math, PhD 2024

George was awarded an NSF Graduate Research Fellowship, 2021-2024.

George was awarded an NSF Postdoctoral Fellowship, 2024-2027.

Next position: Postdoc, California Institute of Technology

Hastewell, Alasdair.

*Robust spectral representations and model inference for biological dynamics*, MIT Math, PhD 2024

Alasdair was awarded a MathWorks Science Fellowship, MIT School of Science, 2021-2022.

He received the inaugural David J. Benney Prize, MIT Mathematics, 2023.

Alasdair was awarded an NITMB Postdoctoral Fellowship, 2024-2027.

Next position: Postdoc, NSF-Simons National Institute for Theory and Mathematics in Biology, Northwestern University and University of Chicago

Romeo, Nicolas.

*Geometry and transport in development*, MIT Physics, PhD 2023

Nico received the Robert B. Guenassia Award of the MIT Office of Graduate Education, 2020.

He was awarded a MathWorks Science Fellowship, MIT School of Science, 2021-2022.

He was awarded the Biological Physics Postdoctoral Fellowship at University of Chicago, 2023-2026.

Next position: Postdoc, University of Chicago

Skinner, Dominic.

*Topological order and entropy production in living systems*, MIT Math, PhD 2022

Dominic was selected for an NSF Mathematical Sciences Graduate Internship at ANL, 2020.

He received a MathWorks Science Fellowship, MIT School of Science, 2020-2021.

He was awarded an NSF-Simons Postdoctoral Fellowship at Northwestern University, 2022-2025.

Next position: Postdoc, Northwestern University

Current position: Associate Research Scientist, Flatiron Institute

Supekar, Rohit.

*Learning and investigating phenomenological models for active matter*, MIT MechE, PhD 2021

Rohit was awarded a MathWorks Engineering Fellowship, MIT School of Engineering, 2020-2021.

Next position: New York Times, Data Scientist

Patil, Vishal.

*Topology, geometry and mechanics of elastic rods and fibers*, MIT Math, PhD 2021

Vishal was the recipient of a MathWorks Science Fellowship, MIT School of Science, 2020-2021.

He was awarded a Stanford Science Fellowship, 2021-2024.

Next position: Postdoc, Stanford University

Current position: Assistant Professor of Mathematics, UCSD

Song, Boya.

*Computational modeling of bacterial biofilms*, MIT Math, PhD 2021

Boya was awarded the Graduate Student Appreciation Fellowship, MIT Math, 2020-2021.

Next position: System Developer, InterSystems

Miller, Pearson.

*Pattern formation on active chemo-mechanical surfaces*, MIT Physics, PhD 2020

Pearson was the recipient of a NDSEG Fellowship, Office of Naval Research, 2014-2018.

He was awarded Flatiron Research Fellowship by the Simons Foundation, 2020-2022.

Next position: Postdoc, Flatiron Institute

Current position: Assistant Professor of Mathematics, UCSD

Mok, Rachel.

*Individual-based GPU simulation framework for collective bacterial dynamics in swarms and biofilms*, MIT MechE, PhD 2019

Rachel was awarded the Chyn Duog Shiah Memorial Fellowship, MIT OGE, 2018-2019.

Next position: Lecturer, MIT

Forrow, Aden.

*Active flows and networks*, MIT Math, PhD 2018

Aden was awarded a Royal Commission for the Exhibition of 1851 Research Fellowship, 2018-2020.

Next position: Postdoc, Broad Institute & University of Oxford

Current position: Assistant Professor, University of Maine

Słomka, Jonasz.

*Generalized Navier-Stokes equations for active turbulence*, MIT Math, PhD 2018

Jonasz received both the MIT Mathematics Department's 2017 Housman Award for Undergraduate Teaching, and the 2018 Johnson Prize for a co-authored paper published in a major journal.

He was awarded an ETH Fellowship, 2018-2020.

Next position: Postdoc, ETH Zürich

Current position: Junior Group Leader (SNF Ambizione Fellow), ETH Zürich

Postdoctoral Researchers/Instructors Supervised/Mentored:

Berleant, Joseph.

Postdoc, MIT Math, 2024–present

Bacik, Karol.

Instructor, MIT Math, 2023–present

Bryde, Petur.

Postdoc / Instructor, MIT Math, 2023–present

Fei, Chenyi.

Postdoc / Instructor, MIT Math, 2023–present

Choi, Gary.

NSF Fellow & Instructor, MIT Math, 2020–2023

Next position: Vice-Chancellor Assistant Professor, Chinese University of Hong Kong

Kodio, Ousmane.

Instructor, MIT Math, 2019–2023

Next position: Assistant Professor, UC Santa Barbara

Burns, Keaton.

Instructor, MIT Math, 2019–2023

Next position: Research Scientist, MIT

Totz, Jan.

Postdoc, MIT MechE (jointly with Mathias Kolle), 2019–2023

Recipient of a Feodor Lynen Fellowship by the Alexander von Humboldt Foundation, 2019-2021

Kos, Žiga.

Postdoc, MIT Math, 2019–2021

Recipient of an ARRS Seal of Excellence Postdoctoral Fellowship, 2019-2022

Next position: ARRS Fellow, University of Ljubljana

Current position: Assistant Professor, University of Ljubljana

Mietke, Alexander.

Postdoc, MIT Math, 2019–2022

Recipient of an EMBO Longterm Fellowship and a DFG Postdoctoral Fellowship, 2019-2021

Next position: Lecturer, University of Bristol

Current position: Associate Professor, University of Oxford

Heinonen, Vili.

Postdoc, MIT Math, 2017–2019; Instructor, MIT Math, 2019–2021

Recipient of the Säätiöiden postdoc -pooli Fellowship, 2017-2019

Next position: Researcher, University of Helsinki

Ronellenfitsch, Henrik.

Instructor, MIT Math, 2017–2020

Next position: Assistant Professor, Williams College

Current position: Systems Engineer, ZEISS

Pearce, Philip.

Instructor, MIT Math, 2016–2019

Next position: Independent Theory Fellow, Harvard Medical School

Current position: Associate Professor, University College London

Stoop, Norbert.

Postdoc MIT Math 2013-2014; Instructor, MIT Math, 2014-2017; Postdoc, MIT Math, 2017

Recipient of a Swiss National Foundation Fellowship, 2013-2014

Next position: Research Affiliate, ETH Zürich

Current position: Data Scientist, QuantCo

Teaching:

Courses at MIT:

**18.03** Differential equations (Fall 2015, Fall 2016, Fall 2018, Fall 2019, Fall 2021, Fall 2022, Fall 2023)

**18.04** Complex Analysis with Applications (Spring 2019, Fall 2024)

**18.354J** Nonlinear Dynamics II: Continuum Systems, MIT (Spring 2014, Spring 2015, Spring 2020)

**18.S995** Mathematical Concepts in Biology and Biological Physics (Fall 2013, Fall 2014, Spring 2016, Fall 2017)

**18.S996** Introduction to Geometric Algebra (Spring 2022, Spring 2025)

Guest lectures: **18.353** (Fall 2014), **20.416** (Fall 2013, Fall 2014)

Supervisions at University of Cambridge:

Quantum physics. Murray Edwards College (LT 2012)

Statistical & thermal physics. Murray Edwards College (MT 2011)

Quantum mechanics. Murray Edwards College (MT 2011 & MT 2012)

Dynamics & relativity. Murray Edwards College (LT 2011 & LT 2012)

Dynamics & relativity. Fitzwilliam College (LT 2011)

Tutorials at University of Oxford:

Quantum mechanics. Mansfield College (MT 2009 - HT 2010)

Mathematical methods. Lincoln College (MT 2009)

Mathematical methods. Mansfield College, University of Oxford (MT 2009)

M. Phys. Option C6: Statistical & quantum field theory. Class tutor (2008-2009)

Service:

Internal:

DAPER Advisory Board Meeting, 2025-present  
SES Oral Qualifying Exam (with Ali Jadbabaie): Ashley Peake, November 2025, IDSS  
CPW presentation, MIT Biotech Group's Undergraduate Initiative, April 2025  
Presentation at MITCOBx, April 2025  
PhD Committee (with John Bush, Ruben Rosales): Davis Evans, MIT Math, 2025  
MIT Commencement Committee, 2024-present  
School of Science Postdoctoral Fellowship Steering Committee, 2024-present  
Foundational Working Group on the SME Requirements, 2023-24  
SPUR Faculty Mentor, MIT Math, June-August 2023  
Member, MIT Summer Research Program (MSRP) Application Review Committee (ARC), 2023  
Member, MIT CSB Graduate Student Selection Committee, 2023-present  
Faculty Postdoc Officer, MIT Math, 09/2022-present  
IAP coordinator, MIT Math, 09/2022-present  
SPUR/RSI Summer Lecture, July 2022  
Faculty Mentor, MIT Summer Research Program (MSRP): Gabriel Rodriguez-Roig, June-August 2022  
Member, MIT Summer Research Program (MSRP) Application Review Committee (ARC), 2022  
MIT Freshman Advisor, 2021-22  
PhD Committee (with Ming Guo, Roger Kamm): Wenhui Tang, MIT MechE, 2021–2024  
PhD Committee (with Adam Martin, Daniel Needleman, Ethan Garner): Jonathan Jackson,  
MIT Biology/Harvard, 2021–2023  
PhD Committee (with Peko Hosoi, Ali Jadbabaie): Juncal Arbelaiz Mugica, MIT Math, 2021–2022  
PhD Committee (with Nikta Fakhri, Mehran Kardar): Jinghui Li, MIT Physics, 2021–2022  
PhD Committee (with Martin Bazant): Pedro de Souza, MIT ChemE, 2020–2022  
PhD Committee (with Ken Kamrin, Gareth McKinley): Saviz Mowlavi, MIT MechE, 2020–2022  
PhD Committee (with Jeremy England, John Bush): Jacob Mitchell Gold, MIT Math, 2020  
Commencement Exercises 2019  
Investiture of Doctoral Hoods 2019  
Reviewer, Sagol Weizmann-MIT Bridge Program, 2019  
Mentor, MIT-Imperial Exchange Program, 2019  
PhD Committee (with Nikta Fakhri, Jeff Gore, Leonid Levitov): Melis Tekant, MIT Physics, 2019–2021  
PhD Committee (with James Swan, Alfredo Alexander-Katz): Andrew Fiore, MIT ChemE, 2016-2019  
MISTI GSF Scientific Review Committee, 2018  
PhD Committee (with Ruben Rosales, Esteban Tabak): Andrew Rzeznik, MIT Math, 2018  
Commencement Exercises 2018

Investiture of Doctoral Hoods 2018

**18.032x** Reviewer 2017

MIT International Science and Technology Initiatives (MISTI) Faculty Committee, 2015 & 2017

PhD Committee (with Bonnie Berger, Peter Shor): Yun William Yu, MIT Math, 2017

**18.095** IAP Mathematics Lecture Series, 2014, 2015, 2016, 2017, 2018, 2022 & 2024

Math Language Examiner (German), Spring 2014 & Spring 2017, Spring 2018

MIT Freshman Advisor, 2016-17

MISTI Selection Committee, 2016

Organizer, MIT Biophysics Retreat, North Falmouth, Sep 13-14 (90+ participants), Fall 2015

PRIMES & RSI project advisor, 2015-present (Meena Jagadeesan, RSI Student 2015: Semifinalist at the 2015 Siemens Competition)

Organizer, Lunch Seminar for MIT Math Grad Students, 2014-2015

MIT Program Committee for the Biophysics Initiative, 2014-present

Organizer, MIT Biophysics Retreat, Chatham, Sep 14-15 (90+ participants), Fall 2014

MSRP Faculty Mentor, Summer 2014 (Grace Lim, MSRP Student 2014: Cal Poly Pomona President's Special Travel Award to present project at SIAM CSE15)

Co-Organizer, MIT Physical Mathematics Seminar (with John Bush and Ruben Rosales), 2013–present

External:

PhD Committee (William Ryu, David McMillen, Andreas Hilfinger):

Brayden Kell, University of Toronto, 2025

CCB Review Committee, Flatiron Institute, Simons Foundation, 2025

PhD Committee (with Daniel Goldman, David Hu, Emily Weigel, Saad Bhamla):

Harry Tuazon, Georgia Tech, 2024

Tenure Promotion Case Reviewer, Arizona State University, 2024

Habilitation Committee: Pierre Ronceray, Université Aix-Marseille, 2024

NSF Panel, 2023

Direct Submission Editor, PNAS, 2023

Reviewer, Research Fellowship Competition, Gonville & Caius College (Cambridge University), 2022

Reviewer, Research Fellowship Competition, Jesus College (Cambridge University), 2022

PhD Committee (with Teresa Lopez Leon, Denis Bartolo, Tyler Shendruk and Juan de Pablo):

Claire Doré, ESPCI, 2022

PhD Committee (with Ivo Sbalzarini): Karl Hoffmann, TU Dresden, 2022

Reviewer, Israel Science Foundation, 2022

Reviewer, Junior Faculty Hiring Committee, TU Dresden, 2022

Direct Submission Editor, PNAS, 2022

External Member, Tenure Board, Universität Leipzig, 2022-2026

Reviewer, Department of Energy (DOE) Office of Science, 2022  
PhD Committee (with Anand Oza and Travis Askham): Connor Robertson, NJIT, 2021-2023  
Reviewer, Department of Energy (DOE) Office of Science, 2021  
PhD Committee (with Ivo Sbalzarini): Suryanarayana Maddu, TU Dresden, 2021  
PhD Committee (with Jeff Guasto): Amin Dehkharghani, Tufts University, 2021  
NSF Panel, 2020  
Reviewer, Department of Energy (DOE) Office of Science, 2020  
Reviewer, SISSA faculty hiring committee, 2020  
Reviewer, Emmy Noether Programm, Deutsche Forschungsgemeinschaft (DFG), 2020  
Reviewer, European Research Council (ERC), 2020  
Reviewer, NSF Faculty Early Career Development Program (CAREER), 2019  
Advising on book proposals, Cambridge University Press, 2016 & 2019  
Reviewer, European Research Council (ERC), 2019  
Organizer, GSOFIT Invited Session ‘Towards Soft Active Metamaterials’, APS March Meeting, Boston, 2019 (with Francis G. Woodhouse)  
PhD Committee (with Axel Voigt): Sebastian Reuther, TU Dresden, 2019  
Reviewer, Ohio Supercomputer Center, 2018  
Reviewer, Fulbright-Cottrell Award, 2018  
Reviewer, Junior Research Fellowship Competition, Trinity College (Cambridge University), 2018  
Correspondent, Journal Club of Condensed Matter Physics, [www.condmatjclub.org](http://www.condmatjclub.org), 2018  
Referee, Centre Européen de Calcul Atomique et Moléculaire (CECAM), 2017  
Reviewer for Israel Science Foundation (ISF), 2017  
Reviewer, US-Israel Binational Science Foundation (BSF), 2017  
Reviewer, German Research Foundation (DFG), 2015-2019  
Member, Local Organizing Committee, APS DFD Meeting Boston, 2015  
Organizer, Boston Area Physics of Living Systems Hangout, Dec 11 (40+ participants), Fall 2014  
Organizer, Minisymposium ‘Collective Dynamics in Active Suspensions’, SIAM Annual Meeting, Chicago, 2014 (with E. Lushi and D. Saintillan)  
Reviewer, German Academic Exchange Service (DAAD), 2014  
Reviewer, Adams Prize, University of Cambridge, 2014  
Reviewer, W. M. Keck Foundation, 2014  
Reviewer, German-Israeli Foundation for Scientific Research and Development, 2014  
Investment Committee, Murray Edwards College, University of Cambridge, 2011–2013  
Reviewer, South African National Research Foundation, 2008  
Referee for 40+ journals (incl. Nature, Nature Physics, Nature Materials, Nature Communications, Science Advances, PNAS, PRL, Rev Mod Phys, PRX, eLife, Cell Systems, Langmuir, Soft Matter, JFM), since 2005

Preprints:<sup>2</sup>

- K. A. Bacik, J. Ondras, A. Rudkin, J. Dunkel and I. S. Kim  
Submitted
- Y.-C. Chao, S. Gokhale, L. Lin, A. D. Hastewell, A. Bacanu, Y. Chen, J. Li, J. Liu, H. Lee, J. Dunkel and N. Fakhri  
Submitted
- S. Zhang, C. Fei and J. Dunkel  
Nonlinear memory in cell division dynamics across species  
[arXiv:2408.14564](https://arxiv.org/abs/2408.14564), submitted
- C. Meng, J.-S. Wu, Ž. Kos, J. Dunkel, C. Nisoli and I. I. Smalyukh  
*Phys. Rev. X*, in press
- V. Heinonen, A. J. Abraham, J. Słomka, K. J. Burns, P. J. Saenz and J. Dunkel  
Emergent universal statistics in non-equilibrium systems with dynamical scale selection  
[arXiv:2205.01627](https://arxiv.org/abs/2205.01627), submitted

Publications:

- G. Stepaniants, A. D. Hastewell, D. J. Skinner, J. F. Tutz and J. Dunkel  
Discovering dynamics and parameters of nonlinear oscillatory and chaotic systems from partial observations  
*Phys. Rev. Research*, 6: 043062, 2024
- V. P. Patil, Ž. Kos and J. Dunkel  
Harmonic flow field representations of quantum bits and gates  
*Phys. Rev. Research*, 6: 043039, 2024
- J. F. Tutz, A. D. McDougal, L. Wagner, S. Kang, P.T.C. So, J. Dunkel, B.D. Wilts and M. Kolle  
Cell membrane buckling governs early-stage ridge formation in butterfly wing scales  
*Cell Reports Physical Science*, 5(7): 102063, 2024
- T. Ohmura, D. J. Skinner, K. Neuhaus, G. P. T. Choi, J. Dunkel and K. Drescher  
In vivo microrheology reveals local elastic and plastic responses inside three-dimensional bacterial biofilms  
*Advanced Materials*, 36(29): 2314059, 2024  
Selected as *Editor's Choice*
- M. Salvalaglio, D. J. Skinner, J. Dunkel and A. Voigt  
Persistent homology and topological statistics of hyperuniform point clouds  
*Phys. Rev. Research*, 6: 023107, 2024
- N. Romeo, J. Słomka, J. Dunkel and K. J. Burns  
Vortex line entanglement in active Beltrami flows  
*J. Fluid Mech.*, 982: A12, 2024

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<sup>2</sup>•arising from a supervised PhD thesis; ◦joint work with MIT Math instructor/postdoc; +with undergraduate student

- H. Jeckel, K. Noshu, K. Neuhaus, A. D. Hastewell, D. J. Skinner, D. Saha, N. Netter, N. Paczia, J. Dunkel and K. Drescher  
Spatio-temporal transcriptomes of bacterial swarms reveal supra-generational cooperation during multicellular development  
*Nature Microbiology*, 8: 2378-2391, 2023
- J. A. Jackson, N. Romeo, A. Mietke, K. J. Burns, J. F. Tetz, A. C. Martin, J. Dunkel and J. Imran Alsous  
Scaling behavior and control of nuclear wrinkling  
*Nature Physics*, 19:1927-1935, 2023  
Selected as *Cover Article*
- D. J. Skinner, H. Jeckel, A. C. Martin, K. Drescher and J. Dunkel  
Topological packing statistics distinguish living and non-living matter  
*Science Advances*, 9: eadg1261, 2023
- A. E. Cohen, A. D. Hastewell, S. Pradhan, S. W. Flavell and J. Dunkel  
Schrödinger dynamics and Berry phase of undulatory locomotion  
*Physical Review Letters*, 130: 258402, 2023  
O. Hallatschek, S. S. Datta, K. Drescher, J. Dunkel, J. Elgeti, B. Waclaw and N. S. Wingreen  
Proliferating active matter  
*Nature Reviews Physics*, 5: 407-419, 2023
- V. P. Patil, H. Tuazon, E. Kaufman, T. Chakraborty, D. Qin, J. Dunkel and M. S. Bhamla  
Ultrafast reversible self-assembly of living tangled matter  
*Science*, 380: 392-398, 2023  
Selected for *Science Perspective*
- R. Supekar, B. Song, A. D. Hastewell, G. P. T. Choi, A. Mietke and J. Dunkel  
Learning hydrodynamic equations for active matter from particle simulations and experiments  
*Proc. Natl. Acad. Sci. U.S.A.*, 120(7): e2206994120, 2023
- H. Jeckel, F. Diaz-Pascual, D. J. Skinner, B. Song, E. Jimenez Sibert, E. Jelli, S. Vaidya, J. Dunkel and K. Drescher  
Shared biophysical mechanisms determine early biofilm architecture development across different bacterial species  
*PLoS Biol.*, 20(10): e3001846, 2022
- Ž. Kos and J. Dunkel  
Nematics bits and universal logic gates  
*Science Advances*, 8: eabp8371, 2022
- H. Kim, D. J. Skinner, D. S. Glass, A. E. Hamby, B. A. R. Stuart, J. Dunkel and I. H. Riedel-Kruse  
Synthetic 4-bit adhesion logic and universal multicellular interface patterning  
*Nature*, 608: 324-329, 2022  
Selected as *Cover Article* and for *Nature News & Views*

- T. H. Tan, A. Mietke, J. Li, Y. Chen, H. Higinbotham, P. J. Foster, S. Gokhale, J. Dunkel and N. Fakhri  
Odd dynamics of living chiral crystals  
*Nature*, 607: 287-293, 2022  
Selected for *Nature News & Views*
- A. Mietke and J. Dunkel  
Anyonic defect braiding and spontaneous chiral symmetry breaking in dihedral liquid crystals  
*Phys. Rev. X*, 12: 011027, 2022
- N. Romeo, A. Hastewell, A. Mietke and J. Dunkel  
Learning developmental mode dynamics from single-cell trajectories  
*eLife*, 10: e68679, 2021
- D. J. Skinner and J. Dunkel  
Estimating entropy production from waiting time distributions  
*Phys. Rev. Lett.*, 127: 198101, 2021  
Selected as *Editors' Suggestion* and *Physics Viewpoint*
- M. James, D. A. Suchla, J. Dunkel and M. Wilczek  
Emergence and melting of active vortex crystals  
*Nature Communications*, 12: 5630, 2021
- J. Liu, J. F. Tetz, P. W. Miller, A. Hastewell, J. Dunkel and N. Fakhri  
Topological braiding and virtual particles on the cell membrane  
*Proc. Natl. Acad. Sci. U.S.A.*, 118(34): e2104191118, 2021
- P. J. Saenz, G. Pucci, S. E. Turton, A. Goujon, R. R. Rosales, J. Dunkel and J. W. M. Bush  
Emergent order in hydrodynamic spin lattices  
*Nature*, 596: 58-62, 2021
- + T. Kotwal, F. Moseley, A. Stegmaier, S. Imhof, H. Brand, T. Kiessling, R. Thomale, H. Ronellenfitsch and J. Dunkel  
Active topoelectrical circuits  
*Proc. Natl. Acad. Sci. U.S.A.*, 118(32): e2106411118, 2021
- V. P. Patil and J. Dunkel  
Chiral edge modes in Helmholtz-Onsager vortex systems  
*Phys. Rev. Fluids*, 6: 064702, 2021
- K. Drescher and J. Dunkel  
Learning principles of bacterial biofilm dynamics from the behavior of single cells  
In *Roadmap on emerging concepts in the physical biology of bacterial biofilms*  
*Phys. Biol.*, 18: 051501, 2021
- M. Denk-Lobnig, J. F. Tetz, N. C. Heer, J. Dunkel and A. C. Martin  
Combinatorial patterns of graded RhoA activation and uniform F-actin depletion promote tissue curvature  
*Development*, 148(11): dev199232, 2021

- D. J. Skinner and J. Dunkel  
Improved bounds on entropy production in living systems  
*Proc. Natl. Acad. Sci. U.S.A.*, 118(18): e2024300118, 2021
- J. Imran Alsous, N. Romeo, J. Jackson, F. M. Mason, J. Dunkel and A. C. Martin  
Dynamics of hydraulic and contractile wave-mediated fluid transport during *Drosophila* oogenesis  
*Proc. Natl. Acad. Sci. U.S.A.*, 118(10): e2019749118, 2021
- D. J. Skinner, B. Song, H. Jeckel, E. Jelli, K. Drescher and J. Dunkel  
Topological metric detects hidden order in disordered media  
*Phys. Rev. Lett.*, 126: 0438101, 2021  
Selected as *Editors' Suggestion* and *Physics Viewpoint*
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- P. W. Miller and J. Dunkel  
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*Soft Matter*, 16: 3991-3999, 2020
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*Front. Phys.*, 7: 178, 2019  
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- H. G. Yevick, P. W. Miller, J. Dunkel and A. C. Martin  
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- A. Dehkharghani, N. Waisbord, J. Dunkel and J. S. Guasto  
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*Nature Physics*, 14: 1016–1021, 2018  
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*Proc. Natl. Acad. Sci. U.S.A.*, 115(35): 8665–8670, 2018  
  
J. Dunkel  
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*Phys. Rev. Lett.*, 120: 164503, 2018  
  
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Nonlinear dynamics and fluctuations of dissipative Toda chains

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Invited talks (past and forthcoming):

*Self-organized dynamics in living materials*

Workshop ‘Recent challenges in the mathematical design of new materials’,  
Isaac Newton Institute, Cambridge (UK), August 2025

*Spectral representations and model inference for multiscale biological dynamics*

Plenary Talk, SIAM Conference on Applications of Dynamical Systems (DS 25),  
Denver (USA), May 2025

*Learning active particle dynamics and hydrodynamics from experimental data*

APS Global Physics Summit, Focus Session ‘Machine learning for small-scale fluid flow and transport phenomena’, Anaheim (USA), March 2025

*Model inference for active matter*

Brandeis-Harvard-MIT-Northeastern Joint Mathematics Colloquium, Northeastern University, Boston (USA), March 2025

*Spectral representations and model inference for multi-scale biological dynamics*

Physics Colloquium, UC San Diego, La Jolla (USA), March 2025

*Spectral dynamics of living matter*

Conference ‘The Many Faces of Active Mechanics’, KITP / UC Santa Barbara (USA), October 2024

*Mechanics of knotted and chiral living matter*

WPI-SKCM<sup>2</sup> Summer School & joint WPI-ICReDD Research Symposium,  
Hokkaido University, Sapporo (Japan), July 2024

*Quantitative Model Inference for Living Matter*

Center for Studies in Physics and Biology Seminar, Rockefeller University, New York (USA), May 2024

*Programmable living materials and quantitative model inference for active matter*

Physics Colloquium, Ohio University, Athens (USA), April 2024

*Quantitative model inference for living matter*

Janelia Computation & Theory Seminar, HHMI Janelia Research Campus, Virginia (USA), April 2024

*Anti-diffusive pattern formation in quantum and active fluids*

Workshop ‘Mathematical and Computational Modelling of Anti-Diffusive Phenomena’,  
Isaac Newton Institute, Cambridge (UK), March 2024

*Quantitative model inference for living matter*

Soft Matter Seminar, DAMTP, Cambridge (UK), March 2024

*Topological packing statistics of living and non-living matter*

Seminar GEOTOP-A, Online, March 2024

*Symmetry-informed model inference for active matter*

Applied Math Colloquium, University of Arizona (USA), February 2024

*Topological packing statistics of living and non-living matter*  
School of Mathematical and Statistical Sciences, Arizona State University (USA), January 2024

*Topological packing statistics of living and non-living matter*  
Berkeley Statistical Mechanics Meeting  
UC Berkeley (USA), January 2024

*Model inference for living matter: from biological data to dynamical equations*  
EMBO-EMBL Symposium: Theory and Concepts in Biology  
Heidelberg (Germany), July 2023

*Topological statistics of living and non-living matter*  
Workshop ‘New statistical physics in living matter: non equilibrium states under adaptive control’,  
Isaac Newton Institute, Cambridge (UK), July 2023

*Control of non-equilibrium pattern formation in multicellular systems*  
Active Matter at Surfaces and in Complex Environments  
MPI for the Physics of Complex Systems, Dresden (Germany), June 2023

*Active Networks*  
Network Science Institute, Northeastern University, Boston (USA), June 2023

*Spectral representations and model inference for multicellular dynamics*  
Theory Lunch, Department of Systems Biology, Harvard Medical School, Boston (USA), May 2023

*Programmable living materials and quantitative models of active matter*  
Soft Matter and Biological Physics Seminar, Syracuse University, Syracuse (USA), April 2023

*Topological statistics and model inference for active matter*  
Guest lecture, Active Matter Graduate Course, Harvard, Cambridge (USA), April 2023

*Braiding in Biological and Soft Matter*  
WPI Kickoff- Symposium, Hiroshima (Japan), March 2023

*Symmetry-informed model inference for living matter*  
Symposium: Data-driven Dynamical Systems in Biology and Soft Matter  
APS March Meeting, Las Vegas (USA), March 2023

*Towards programmable living materials and quantitative models of active matter*  
CMSA Active Matter Seminar, Harvard, Cambridge (USA), February 2023

*Model inference for synthetic & living active matter*  
Common Task Framework (CTF) for Science and Engineering, NSF AI Institute in Dynamic Systems  
(Virtual, USA), February 2023

*Topological mechanics of passive and active tangles*  
WPI Seminar, Hiroshima University, Hiroshima (Japan), January 2023

*Inferring hydrodynamic models for multicellular dynamics from live-imaging data*  
AMS Special Session on Modeling Collective Behavior in Biology,  
2023 Joint Mathematics Meeting, Boston (USA), January 2023

*Symmetry-informed model inference for active matter*

AMS Special Session on Dynamics of PDEs on Heterogeneous Domains: Theory & Applications, 2023 Joint Mathematics Meeting, Boston (USA), January 2023

*Control of non-equilibrium pattern formation in multicellular systems*

Conference on Control of Self-Organizing Nonlinear Systems, Sonderforschungsbereich 910, Potsdam (Germany), November 2022

*Towards programmable living materials and quantitative models of active matter*

School of Physics Colloquium, Georgia Tech (USA), October 2022

*Towards programmable living materials and quantitative models of active matter*

Physics Colloquium, Brandeis University (USA), October 2022

*Topological statistics and symmetry-informed model inference for active matter*

Condensed Matter Seminar, University of Minnesota (USA), September 2022

*Towards programmable living materials and quantitative models of active matter*

Current and Future Themes in Soft and Biological Active Matter, Nordita, Stockholm (Sweden), August 2022

*Symmetry-informed model inference for active matter*

Colloquium, SFB 1294 Data Assimilation, University of Potsdam (Germany), July 2022

*Estimating entropy production from waiting time distributions*

Symposium in remembrance of Lutz Schimansky-Geier, Humboldt University Berlin (Germany), July 2022

*Learning biophysical models from live-imaging data*

Seminar Series: Current research in Bioinformatics, Biozentrum, University of Basel (Switzerland), June 2022

*Symmetry-informed model inference for active matter*

Data-Driven Modeling Seminar, University of Washington (USA), June 2022

*Learning hydrodynamic models for multicellular dynamics from live-imaging data*

Mechanics of Life, Flatiron Institute (USA), May 2022

*Symmetry-informed model inference for active matter*

Theory of Living Matter Group Online Seminar, University of Cambridge (UK), May 2022

*Symmetry-informed model inference for active matter*

Theoretical Physics Colloquium, University of Oxford (UK), January 2022

*Understanding complex systems dynamics through symmetry-informed model inference*

Joint Colloquium, CASUS/Helmholtz Zentrum Dresden-Rossendorf and TU Dresden (Germany) Online, January 2022

*Altruistic fluid transport during fly egg development*

METANANO 2021, Online / Tbilisi (Georgia), September 2021

*Altruistic fluid transport during fly egg development*

SMB 2021 Mini-symposium ‘Complex Fluids and Flows in Mathematical Biology’

Online, June 2021

*Physics-informed model learning for active and living matter*

EMBO Conference ‘Physics of Living Systems - From Molecules to Tissues’

Online, June 2021

*Spectral design of active mechanical and electrical metamaterials*

SIAM MS 21 Mini-symposium ‘At the intersection of geometry, elasticity and meta-materials’

Online, May 2021

*Topological statistics of bacterial swarms and biofilms*

The Physics of Living Matter, PCTS Workshop, Princeton (USA), January 2021

*Early-stage bacterial biofilms – experiment & modeling*

IWA Biofilms 2020 Virtual Conference: Time Scaling in Biofilm Experiments Workshop, December 2020

*Topological statistics and defects in biological matter*

Applied Mathematics Seminar, University of Birmingham (UK), November 2020

*Topological statistics and defects in biological matter*

Friday Seminar, Courant Institute (USA), November 2020

*Spectral design of active mechanical and electrical metamaterials*

Metamaterials, CUNY (USA), Physical Review Symposium I, September 2020

Invited session presenting outstanding papers from APS journals in 2019

Article selected by APS editors : H. Ronellenfitsch *et al.*, Phys. Rev. Materials 3: 095201

*Symmetry breaking and pattern formation in soft matter and active fluids*

ESAM Seminar, Northwestern, Evanston (USA), January 2020

*Generalized Navier-Stokes equations for active fluids: from bacterial turbulence to planetary waves*

Universality: Turbulence Across Vast Scales, Flatiron Institute, New York (USA), December 2019

*Symmetry breaking in active and quantum fluids*

Physics Colloquium, UMBC, Maryland (USA), November 2019

*Spontaneous symmetry breaking in active fluids*

Fluid Physics of Life, MPI for the Physics of Complex Systems (Germany), October 2019

*Understanding & controlling bacterial dynamics: from swimming and swarming to biofilm formation*

University of Luxembourg (Luxembourg), October 2019

*Understanding & controlling bacterial dynamics: from swimming and swarming to biofilm formation*

IGM Colloquium, EPFL, Lausanne (Switzerland), October 2019

*Learning dynamical information from static data*

Active Matter and Artificial Intelligence, CECAM, Lausanne (Switzerland), September/October 2019

*Bacterial swimming, swarming and biofilm formation*

Joint CIRCS & Physics Seminar, Northeastern University, Boston (USA), September 2019

*Spontaneous symmetry breaking in soft matter and active fluids*

Applied Mathematics Colloquium, MIT, Cambridge (USA), September 2019

*Towards the inverse design of active metamaterials*

Out-of-Equilibrium Soft Matter in Complex Media, CECAM, Lausanne (Switzerland), July 2019

*Symmetry breaking in active and quantum fluids*

Universität Marburg (Germany), June 2019

*Symmetry breaking in active and quantum fluids*

Theoretical Condensed Matter Seminar, Rudolf Peierls Centre, Oxford (UK), June 2019

*Wrinkles, spaghetti & knots*

Workshop ‘Mathematical Design of New Materials’, Isaac Newton Institute, Cambridge (UK), June 2019

*Symmetry breaking in active and quantum fluids*

CMSA Fluid Dynamics Seminar, Harvard, Cambridge (USA), May 2019

*Inverse design of discrete mechanical meta-materials*

16th Annual Conference on Frontiers in Applied and Computational Mathematics, jointly with 11th Northeastern Complex Fluids & Soft Matter Workshop, NJIT, Newark (USA), May 2019

*Towards rationally designed active metamaterials*

Workshop ‘Optimal design of soft matter’, Isaac Newton Institute, Cambridge (UK), May 2019

*Wrinkles, spaghetti & knots*

Mechanical Engineering and Applied Mechanics Colloquium, UPenn, Philadelphia (USA), April 2019

*Discrete and continuous active matter: from bacterial biofilms to autonomous materials*

‘Physics of Life’ Minisymposium, TU Dresden (Germany), April 2019

*Wrinkles, spaghetti & knots*

Applied Mathematics Colloquium, NJIT, Newark (USA), April 2019

*Spontaneous chiral symmetry breaking in active fluids*

APS March Meeting, Focus Session ‘Physics and hydrodynamics of microswimmer suspensions’ Boston (USA), March 2019

*Symmetry breaking and pattern formation in soft matter and active fluids*

PACM Colloquium, Princeton (USA), February 2019

*Wrinkles & spaghetti*

Computations in Science Seminar, University of Chicago (USA), February 2019

*Wrinkles & spaghetti*

Physics Colloquium, Clark College (USA), January 2019

*Higher-order hydrodynamics for active and quantum fluids*

Condensed Matter Seminar, UMass Amherst (USA), January 2019

*Higher-order hydrodynamics for active and quantum fluids*

NIM Conference ‘The Future of Nanoscience’, Tutzing (Germany), September 2018

*1st lecture: Hydrodynamics & control of microbial swimming*

*2nd lecture: Learning dynamical information from static data*

Physical approaches to understanding microbial life, Gif-sur-Yvette/Paris (France), August 2018

*Spontaneous chiral symmetry breaking in active fluids*

Complex Fluids in Biological Systems, BIRS Banff (Canada), July 2018

*Defect Formation Dynamics in Curved Elastic Surface Crystals*

SIAM Annual Meeting (AN18), Minisymposium ‘Defects and Inhomogeneities in Pattern Forming Systems’, Portland, Oregon (USA), July 2018

*Controlling Fracture of Thin Brittle Rods Through Twisting and Quenching*

SIAM Conference on Mathematical Aspects of Materials Science (MS 18), Minisymposium ‘Thin structures: defects, pattern and bifurcations’, Portland, Oregon (USA), July 2018

*Geometric control of pattern formation in soft matter and active fluids*

Physik Kolloquium, Universität Leipzig (Germany), July 2018

*Mathematische Modellierung komplexer Systeme*

Schule-MIT-Wissenschaft, Hamburg (Germany), June 2018

*Spontaneous chiral symmetry breaking in active fluids*

MPIDS Colloquium, Max Planck Institute for Dynamics and Self-Organization, Göttingen (Germany), June 2018

*Chiral symmetry breaking in active fluids*

Topology in Complex Fluids, Lorentz Center, Leiden (Netherlands), May 2018

*Spontaneous chiral symmetry breaking in active fluids*

Keynote talk, Brown/Boston University Seminar in PDE & Dynamics, Providence (USA), April 2018

*Spontaneous chiral symmetry breaking in active fluids*

Hauptvortrag, Symposium ‘Physics of Biological and Synthetic Active Matter’, DPG Spring Meeting, Berlin (Germany), March 2018

*Entropic effects in cell lineage tree packings*

Mechanics in Morphogenesis, Princeton Center for Theoretical Science, Princeton (USA), February 2018

*Surface pattern formation in soft bilayer materials, embryos and oocytes*

Center for Computational Biology, Flatiron Institute, New York (USA), December 2017

*Symmetry breaking and mode selection in soft and active matter systems*

Physics Colloquium, Boston University (USA), November 2017

*Geometric control of microbial fluids: From bacterial spin lattices to active matter logic*  
Physics Colloquium, Lehigh University (USA), November 2017

*Geometric control of microbial fluids: From bacterial spin lattices to active matter logic*  
Greater Boston Statistical Mechanics Meeting, MIT (USA), October 2017

*Geometric control of microbial fluids: From bacterial spin lattices to active matter logic*  
Design and Control of NanoSystems, Venice (Italy), September 2017

*Geometric control of microbial fluids: from bacterial spin lattices to active matter logic*  
XXVI. International Materials Research Congress, Cancun (Mexico), August 2017

*Geometric control of microbial fluids: from bacterial spin lattices to active matter logic*  
SES 2017, 54th Annual Meeting, Boston (USA), July 2017

*From bacterial spin lattices to active matter logic*  
Plenary talk, Nonlinear Dynamics in Electronic Systems, Zernez (Switzerland), June 2017

*Spontaneous mirror-symmetry breaking and inverse energy transport in 3D active fluids*  
Fluids and Structures: Interaction and Modeling, Naples (Italy), May 2017

*Geometric control of pattern formation in elastic materials and active fluids*  
Quantum Science and Technology Seminar, Department of Physics, University of Massachusetts, Boston (USA), May 2017

*Geometric control of pattern formation in elastic materials and active fluids*  
Condensed Matter and Surface Science (CMSS) Colloquium, Ohio University, Athens (USA), April 2017

*Phenomenological higher-order PDE models for active suspensions*  
APS March Meeting, New Orleans (USA), March 2017

*Geometry-dependent viscosity reduction in sheared active fluids*  
SIAM CSE, Atlanta (USA), February 2017

*Geometric control of pattern formation in elastic materials and active fluids*  
Joint Colloquium, Applied Mathematics Department and Department of Applied Physical Sciences, UNC-Chapel Hill (USA), January 2017

*Mathematische Modellierung weicher and biologischer Materie*  
Schule-MIT-Wissenschaft, Hamburg (Germany), November 2016

*Active flow networks*  
Colloquium 'Irreversible Processes and Selforganization', Berlin Center for Studies of Complex Chemical Systems, Humboldt University, Berlin (Germany), October 2016

*Geometric control of pattern formation in soft elastic materials and active fluids*  
Eugene Wigner Colloquium, Institute of Physics, Technical University, Berlin (Germany), October 2016

*Geometric control of pattern formation in elastic materials and active fluids*  
Widely Applied Math Seminar, SEAS, Harvard (USA), October 2016

*Pattern formation in soft and biological matter*

Department of Physics, Durham University (UK), July 2016

*Controlling directional fluctuations in collective bacterial swimming*

ECMTB, Minisymposium on Stochasticity in Collective Behaviour of Cells, Nottingham (UK), July 2016

*Controlling collective bacterial swimming*

SIAM Life Sciences Conference, Minisymposium on Large-Scale Consequences of Microbial Interactions, Boston (USA), July 2016

*Pattern formation in soft and biological matter*

Physics Colloquium, Institute of Physics, University of Bayreuth (Germany), June 2016

*Wrinkling transitions in curved soft bilayer materials*

Plenary Talk, COSMINNOV, Orleans (France), May 2016

*Bacterial spin lattices*

Statistical Mechanics Conference, Rutgers University (USA), May 2016

*Pattern formation in soft and biological matter*

Lefschetz Center for Dynamical Systems Seminar, Brown University (USA), April 2016

*Pattern formation in soft and biological matter*

Applied & Computational Math Seminar, Department of Mathematics, UW Madison (USA), April 2016

*Pattern formation in soft and biological matter*

MMEC Seminar Series, Department of Mechanical Engineering, MIT (USA), March 2016

*Bacterial sheets*, Geometry, Elasticity, Fluctuations and Order in 2D Soft Matter KITP / UC Santa Barbara (USA), January 2016

*Pattern formation in soft and biological matter*

Martin Weiner Lecture Series, Department of Physics Colloquium, Brandeis University (USA), December 2015

*Hydrodynamics and control of microbial swimming*

Bioengineering Colloquium, Stanford University (USA), June 2015

*Surface interactions and rheotaxis of swimming cells*

Small meets large: connecting microfluidics with oceanography, OIST, Okinawa (Japan), May 2015

*Quantifying and controlling microbial swimming*

APS March Meeting, San Antonio (USA), March 2015

*Hydrodynamics and control of microbial swimming*

Condensed Matter & Biological Physics Seminar, Brown University (USA), October 2014

*Hydrodynamics and control of microbial swimming*

New England Complex Fluids Workshop, Brandeis University (USA), September 2014

*Hydrodynamics and control of microbial swimming*

Statistical Physics of Self-Propelled Particles: Theory and Experiment, 565th Wilhelm and Else Heraeus Seminar, Bad Honnef (Germany), June 2014

*Thermodynamic laws of isolated systems*

Department of Physics, Humboldt-Universität zu Berlin (Germany), June 2014

*Control of microbial locomotion by boundaries and flow gradients*

Mechanical Engineering Departmental Seminar, Tufts (USA), April 2014

*Hydrodynamics and control of microbial swimming*

SIAM & CCE Invited Faculty Seminar, MIT (USA), April 2014

*Control of microbial locomotion by boundaries and flow gradients*

Active Processes in Living and Nonliving Matter, KITP UC Santa Barbara (USA), February 2014

*Hydrodynamics and control of microbial locomotion*

Applied Mathematics Seminar, Harvard (USA), January 2014

*Hydrodynamics and control of bacterial swimming*

MIT Biophysics Retreat, Falmouth (USA), September 2013

*Bacterial Turbulence*

Workshop 'Dynamics of Suspensions, Gels, Cells and Tissues', Isaac Newton Institute, Cambridge (UK), June 2013

*Inconsistent thermodynamics and negative absolute temperature*

Condensed Matter Theory Seminar, Goethe University, Frankfurt (Germany), June 2013

*Meso-scale turbulence and symmetry-breaking in microbial fluids*

Berlin Center for Studies of Complex Chemical Systems Seminar, PTB/Max-Planck-Society, Berlin (Germany), October 2012

*Microbial swimming lessons: hydrodynamics and transport in living fluids*

Biophysics Seminar, UC Berkeley (USA), April 2012

*Microbial swimming lessons: hydrodynamics and transport in living fluids*

Applied Mathematics Seminar, Massachusetts Institute of Technology (USA), March 2012

*Statistical physics and hydrodynamics of microbial fluids*

DAMTP Fluid Mechanics Seminar, University of Cambridge (UK), January 2012

*Brownian motion and thermodynamics in relativity*

KFKI RMKI, Hungarian Academy of Sciences, Budapest (Hungary), December 2011

*Hydrodynamics of bacteria and algae*

OCCAM, University of Oxford (UK), December 2011

*Hydrodynamics of bacteria and algae*

Complexity Forum, University of Warwick (UK), November 2011

*Hydrodynamics of bacteria and algae*

Nanosciences: From molecular systems to functional materials, CeNS, Venice (Italy), September 2011

*Hydrodynamics of bacteria and algae*

Individual & collective dynamics in active suspensions, Institut Henri Poincaré, Paris (France), June 2011

*Hydrodynamics of microorganisms*

Soft Matter & Biophysics Seminar, Ludwig-Maximilians-Universität, München (Germany), May 2011

*Hydrodynamics of microorganisms*

Eugene Wigner Kolloquium, Technische Universität Berlin, Berlin (Germany), April 2011

*Thermodynamics and Brownian motion in special relativity*

Plenary Talk, Gustav Hertz Prize, DPG Frühjahrstagung, Dresden (Germany), March 2011

*Fluid dynamics and Levy fluctuations in dilute suspensions of algae and bacteria*

Condensed Matter Seminar, Max-Planck-Institut für Metallforschung (Germany), December 2010

*Levy diffusion and mixing in dilute suspensions of bacteria and algae*

Theoretical Physics Seminar, University of Manchester (UK), November 2010

*Thermodynamics and Brownian motion in special relativity*

Hauptvortrag, GR1: Moderne Aspekte der Relativitätstheorie, 74. Jahrestagung der DPG und DPG Frühjahrstagung, Bonn (Germany), March 2010

*Nonlocal observables and lightcone-averaging in relativistic thermodynamics*

School of Mathematical Sciences, Queen Mary, University of London (UK), December 2009

*Brownsche Bewegung und Thermodynamik in der Relativitätstheorie*

Augsburger Physikalisches Kolloquium, Universität Augsburg (Germany), October 2009

*Nonlocal observables and lightcone-averaging in relativistic thermodynamics*

22nd Marian Smoluchowski Symposium on Statistical Physics, Zakopane (Poland), September 2009

*Relativistic Brownian motion and thermodynamics*

SKM Prize Symposium, DPG Conference, Dresden (Germany), March 2009

*Diffusion processes and thermostatics in special relativity*

Plenary talk, Klausurtagung, Collaborative Research Center Sfb 484, Kloster Irsee (Germany), April 2008

*Haar measures, relative entropy and relativistic canonical velocity distributions*

Medyfinol '06, XV. Conference on Nonequilibrium Statistical Mechanics and Nonlinear Physics, Mar del Plata (Argentina), December 2006

*States of Aggregation of Ensembles of Particles Interacting via Morse Potentials*

VII. Research Workshop Nucleation Theory and Applications, Bogoliubov Laboratory of Theoretical Physics, JINR, Dubna (Russia), April 2003

Research Contracts and Grants:

MIT SHASS+Connectivity Fund

‘Mathematical Analysis of Inequality in U.S. Legislative and Lobbying Networks’

01/2025–12/2026, USD 193,529

(with In Song Kim, MIT Political Science)

MIT Schwarzman College of Computing SERC Seed Grant Award

‘The Mathematics of Law-Making in the U.S.’

08/01/2024–07/31/2026, USD 99,763

(with In Song Kim, MIT Political Science)

Schmidt Science Polymath Award

08/01/2023–07/31/2028, USD 2,500,000

NSF Award DMR-2214021

‘Collaborative Research: Foundations of programmable living materials through synthetic biofilm engineering and quantitative computational modeling’

01/15/2023–12/31/2025, USD 211,846

Alfred P. Sloan Foundation Award G-2021-16758

‘Nonequilibrium dynamics and structure of biological systems across scales’

10/01/2021–03/01/2024, USD 1,500,000

(with Jeff Gore and Nikta Fakhri, MIT Physics)

MIT John W. Jarve (1978) Seed Fund for Science Innovation

‘New quantitative approaches to determine the mechanical basis of a human birth defect’

09/01/2021–08/31/2022, USD 136,364

(with Adam Martin, MIT Biology)

NSF Award DMS-1952706

‘Collaborative Research: Optimal-Complexity Spectral Methods for Complex Fluids’

07/01/2020–06/30/2023, USD 120,000

MIT Solomon Buchsbaum Fund

‘Geometry & design of active metamaterials’

07/1/2018–06/30/2020, USD 75,000

Royal Society International Exchange Grant

‘Translating Sequencing Data Into Representative And Predictive Fitness Landscape’

03/2017–02/2019, GBP 10,000 (\$12,689.50 USD)

(with Halim Kusumaatmaja, University of Durham, UK)

James S. McDonnell Foundation Complex Systems Scholar Award

‘Evolution of topological features in complex biological systems’

10/1/2016–09/30/2020, USD 450,000

MISTI MIT-Germany Seed Fund

‘Spatial Order and Collective Cell Behavior in Bacterial Biofilms’

12/31/2015–10/31/2018, USD 25,403.87

(with Knut Drescher, MPI for Terrestrial Microbiology, Germany)

NSF Award CBET-1510768  
'Transport and Chemotaxis of Swimming Cells in Porous Media Flows'  
09/1/2015-08/31/2018, USD 281,377.38

Alfred P. Sloan Foundation  
09/1/2015-09/14/2017, USD 50,000

MIT Solomon Buchsbaum Fund  
'Pattern formation and biological fluid flow on curved surfaces'  
07/1/2014-06/30/2015, USD 75,000

Contributions to the Educational Commons not listed in the Service Section above:

Presentations and exhibitions

- Talk, MIT Math Lunch/Pizza Seminar, Spring 2025
- Guest Speaker, MIT Undergraduate Math Association, 2022
- Guest Speaker, MIT Student Colloquium for Undergraduates in Mathematics, 2016
- Mini-presentation, Meet the MIT Mathematicians, Spring 2016
- Discussion Leader, Broad – MIT Math lunch (with A. Regev, P. Rigollet, B. Cleary), June 2015
- Short talk, MIT Math Department Family Weekend, 10/24/2014
- MIT UROP EXPO (with Ruben Rosales and Anna Ferrigno), Spring 2014
- *Nature's Raincoats* exhibit (co-presenter as part Julia Yeomans' group): Summer Science Exhibition of the Royal Society 2009, London (UK), Oxford Science Festival 2010 (UK) & Techfest 2010, IIT Bombay (India)

Academic advising at MIT (course registration/approval, etc.)

- MIT freshman advisees: Emily A. Berzolla (2016–2017), Eric R. Chen (2016–2017), Yehoon Chris Lee (2016–2017), Sebastien X. Wah (2016–2017), Gopal M. Goel (2021–2022), Thomas Guo (2021–2022), Daniel X. Hong (2021–2022), Sean J. Li (2021–2022), Andrei T. Marginean (2021–2022)
- MIT undergraduate advisees: Neil Gurram (2014), Qinru Shi (2014), Ka Yu Tam (2014), David C. Barnes (2014–2018), Suyaesh P. Fulay (2014), Wickham R. Egan (2014–2015), Andrew Xia (2014–2017), Dong-Gil Shin (2014–2015), Vipul T. Vachharajani (2014–2016), Xavier K. Mwangi (2015–2016), Kelly N. Petersen (2015–2016), Cali H. Gallardo (2015–2018), Dimitrios Konstantellos (2016–2019), Marcus Powell (2016–2018), Ulyana Pitarberg (2018–2021), Joseph M. Mastrandrea (2018–2021), Anna R. Osofsky (2018–2021), Du'aa H. Sharif (2018–2019), Julia Yu (2018–2021), Kate E. Yuan (2018–2020), Agustin E. Garcia (2018–2021), Jack-William Barotta (2018–2021), Maritza Gallegos (2019–2023), Zion Hadley (2019–2022), Kenneth L. Cox (2019–2022), Edwin C. Song (2020–2022), Nicholas S. Baginski (2021–2022), Kevin J. Liu (2021–2022), Ritaank Tiwari (2021–2022), Kevin Z. Shao (2021–2023), Veronica Khim (2021–), Maxwell S. Turner (2021–), Alexis V. Zitzmann (2021–), Anna Mikulevica (2022–), Julianne E. Flusche (2022–), Gregory Pypovych (2022–), Natnael A. Asegdew (2022–), Isabella L. Quan (2023–), Christine S. Huang (2023–), Maanasi A. Limaye (2023–), Yaman B. Otuzbir (2023–), Joshua R. Guo (2023–)
- MIT graduate advisees: Jonasz Slomka (2013–2018), Sam Hopkins (2013–2015), Rachel Mok (2014–2019), Aden Forrow (2014–2018), Jacob M. Gold (2015–2021), Vishal P. Patil (2016–2021), Boya Song (2017–2021), Dominic J. Skinner (2017–2022), Alasdair Hastewell (2018–), George Stepaniants (2019–2020), Nicolas Romeo (2019–), Alexander E. Cohen (2020–), Daniel Lazarev (2021–2023), Shijie Zhang (2022–), Andrey Bryutkin (2023–), Harry James Walden (2023–)