

ROBERT MARSLAND III

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Education

Postdoctoral Scholar Theoretical Biophysics Group, Department of Physics, Boston University	2017 - 2020
Doctor of Philosophy in Physics Massachusetts Institute of Technology, Cambridge, MA	2017
Master of Studies in Philosophy of Physics Oxford University, Oxford, UK Distinction	2012
Bachelor of Arts in Physics; Certificate in Latin Language and Literature Princeton University, Princeton, NJ Summa cum laude, GPA 3.9	2011

Awards

National Defense Science and Engineering Graduate Fellowship	2014
Archibald Jackson Prize for achieving a Distinction in a graduate course at Oxford	2012
Elected to membership in the Phi Beta Kappa Society	2011
Elected to membership in the Society of Sigma Xi	2011
Class of 1916 Cup for highest academic standing among four-year varsity athletes	2011

Teaching

Lecturer, <i>Intermediate Mechanics</i> (PY408) <i>Boston University</i> Designed and presented lectures, homework and exams	2018
Media Arts and Sciences (MAS) Facilitator <i>Massachusetts Institute of Technology</i> Organized and led weekly breakfast meetings for freshmen in the MAS program, consisting of interactive physics demonstrations and research talks from MIT Media Lab groups; organized and led four physics review sessions each semester.	2013 - 2014
Graduate Teaching Assistant, <i>Introduction to Classical Mechanics</i> (8.01) <i>Massachusetts Institute of Technology</i> Managed a team of five undergraduate teaching assistants to facilitate three hours of Technology Enabled Active Learning classes per week.	2013

Seminars

Statistical Mechanics of Microbiomes

Complex Systems Colloquium, University of Michigan
September 24, 2019

Designing Diverse Microbial Consortia: Challenges and Opportunities

Indigo Ag, Inc.
July 18, 2019

Towards a Statistical Physics of Ecosystems

Center for the Physics of Biological Function, Princeton University
April 2, 2019

Machine Learning, Statistical Physics and Ecological Dynamics

APS March Meeting, invited session
March 7, 2019

Statistical Mechanics of Microbiomes

Parsons Lab Microbial Systems Seminar Series, MIT
February 20, 2019

Statistical Mechanics of Microbiomes

Working Group on Irreversible Processes in Ecological Evolution, Santa Fe Institute
January 29, 2019

Microbial Communities in Python

Guest lecture for MIT graduate course *Computational Ecology* (1.871)
October 3, 2018

Mean-field theory for ecological steady states

MIT Nonequilibrium Statistical Mechanics Seminar
February 20, 2018

Statistical Mechanics of Microbial Communities

BU Biophysics Seminar
February 5, 2018

Dynamic Self-Assembly in Living Matter

Tel Aviv University Biosoft Seminar
July 31, 2017

The Edge of Thermodynamics: Driven Steady States in Physics and Biology

IGERT Summer Institute, Brandeis University
May 31, 2017

Dynamic Self-Assembly in Living Matter

BU Biophysics Seminar
December 14, 2016

Dynamic Self-Assembly in Living Matter

Lewis-Sigler Theory Symposium, Princeton University
November 30, 2016

Short Talks and Posters

The Minimum Environmental Perturbation Principle: Niche Theory as Optimization

Gordon Research Conference: Stochastic Physics in Biology
January 6-11, 2019

The Minimum Environmental Perturbation Principle: Niche Theory as Optimization

Theoretical Biophysics Workshop, Emory University
January 16-18, 2019

The Community Simulator: a Python package for community ecology

PCTS Workshop: Bridging Theory and Experiment in Microbial Communities
December 12-14, 2018

Available energy fluxes drive a transition in diversity, stability, and functional structure of microbial communities

BU Biological Design Center Symposium
May 16, 2018

Who's in Charge? From environmental filtering to ecosystem engineering in microbial communities

MIT Physics of Living Systems Short Talks
May 11, 2018

Statistical Mechanics of Microbial Communities

MIT-Harvard Microbiome Symposium
April 13, 2018

Statistical Mechanics of Microbial Communities

Simons Conference on Theory & Biology
April 13, 2018

Statistical Mechanics of Microbial Communities

APS March Meeting
March 9, 2018

Far-from-equilibrium distribution from near-steady-state work fluctuations

UC Berkeley Stat Mech Meeting, Poster Session
January 8, 2016

Some thermodynamic aspects of driven steady states

MIT Biophysics Retreat
September 14, 2015

Counting states in driven systems

New England Complex Fluids Workshop
June 27, 2014

Meetings/Seminars Organized

BU Theory in Biology Meeting

Spring 2018

Boston University

Organized a two-day workshop on the Boston University campus featuring twelve invited speakers on the topic of “community ecology, evolution and the origin of life.”

Co-organizers: Prof. Kirill Korolev, Prof. Pankaj Mehta, Prof. Daniel Segre

Boston University Biophysics Seminar

2017 - 2018

Boston University

Led a team of three faculty members to coordinate weekly lunch seminars given by local faculty and postdocs for the BU biophysics community.

Co-organizers: Prof. Kirill Korolev, Prof. Maria Kamenetska, Prof. Daniel Segre

Non-Equilibrium Statistical Mechanics Seminar

Fall 2016

Massachusetts Institute of Technology

Organized weekly presentations by graduate students and postdocs on important tools and results in theoretical non-equilibrium statistical mechanics.

Philosophical Presuppositions of Science

Summer 2015

Elmbrook University Center

Planned and led weekly discussions with MIT and Harvard students from a variety of disciplines on the place of scientific knowledge within the broader context of human knowledge. Selected topical readings each week from articles by Richard Feynman, Philip Anderson, and Paul Davies.

Scientific Representation

Spring 2012

Grandpont House, Oxford

Planned and led weekly discussions with Oxford students from a variety of disciplines on readings from *Scientific Representation* by Bas van Fraassen (2008).

Co-organizer: Dr. Nicholas Teh

Journals Refereed

Physical Review Letters, Physical Review E, Physical Review Research, Physica A, American Journal of Physics, PLOS One, PLOS Computational Biology, Ecology Letters, Journal of Statistical Mechanics, Entropy, iScience

Publications

P. Mehta and R. Marsland III, "Cross-feeding shapes both competition and cooperation in microbial ecosystems." *arXiv:2110.04965* (2021).

W. Cui, R. Marsland III and P. Mehta, "Diverse communities behave like typical random ecosystems." *Phys. Rev. E* **104**:034416 (2021).

F.S. Valdovinos and R. Marsland III, "Niche theory for mutualism: A graphical approach to plant-pollinator network dynamics." *The American Naturalist*. **197**:393 (2021).

R. Marsland III, O. Howell, A. Mayer and P. Mehta, "Tregs self-organize into a computing ecosystem and implement a sophisticated optimization algorithm for mediating immune response." *PNAS*. **118**:e2011709118 (2021).

R. Marsland III and P. Mehta, "Data-driven modeling reveals a universal dynamic underlying the COVID-19 pandemic under social distancing." *arXiv:2004.10666* (2020).

W. Cui, R. Marsland III and P. Mehta, "Effect of resource dynamics on species packing in diverse ecosystems." *Phys. Rev. Lett.* **125**:048101 (2020).

O. Howell, W. Cui, R. Marsland III and P. Mehta, "Machine learning as ecology." *J. Phys. A: Math. Theor.* **53**:334001 (2020).

R. Marsland III, W. Cui and P. Mehta, "The Minimum Environmental Perturbation Principle: A New Perspective on Niche Theory." *The American Naturalist*. **196**:291 (2020).

R. Marsland III, W. Cui, J. Goldford and P. Mehta, "The Community Simulator: a Python package for microbial ecology." *PLoS One*. **15**:e0230430 (2020).

R. Marsland III, W. Cui and P. Mehta, "A minimal model for microbial biodiversity can reproduce experimentally observed ecological patterns." *Scientific Reports*. **10**:3308 (2020).

L. Ikonomidou, M.J. Herriges, S.L. Lewandowski, R. Marsland, C. Villacorta, I.S. Caballero, D.B. Frank, R.M. Sanghrajka, K. Dame, M.M. Kańduła, J. Hicks-Berthet, M.L. Lawton, C. Christodoulou, A.J. Fabian, E. Kolaczyk, X. Varelas, E.E. Morrissey, J.M. Shannon, P. Mehta and D.N. Kotton, "The in vivo genetic program of murine primordial lung epithelial progenitors." *Nature Communications*. **11**:1 (2020).

Joshua E. Goldford, Hyman Hartman, Robert Marsland III and Daniel Segrè, "Environmental boundary conditions for the origin of life converge to an organo-sulfur metabolism." *Nature Ecology & Evolution* **3**:1715 (2019).

R. Marsland III, W. Cui and J. Horowitz, "The Thermodynamic Uncertainty Relation in biochemical oscillations." *Journal of the Royal Society: Interface* **16** (2019).

P. Mehta, W. Cui, C.-H. Wang and R. Marsland III, "Constrained optimization as ecological dynamics with applications to random quadratic programming in high dimensions." *Phys. Rev. E* **99**:052111 (2019).

R. Marsland III, W. Cui, J. Goldford, A. Sanchez, K. Korolev and P. Mehta, "Available energy fluxes drive a transition in the diversity, stability and functional structure of microbial communities." *PLoS Comp. Biol.* **15**:e1006793 (2019).

R. Marsland III and J. England, "Active regeneration unites high- and low-temperature features in cooperative self-assembly," *Phys. Rev. E* **98**:022411 (2018).

R. Marsland III and J. England, "Limits of Prediction in Thermodynamic Systems: A Review," *Rep. Prog.*

Phys. **81**:016601 (2018).

K. He, R. Marsland III, S. Upadhyayula, E. Song, S. Dang, B. R. Capraro, W. Wang, W. Skillern, R. Gaudin, M. Ma and T. Kirchhausen, "Dynamics of phosphoinositide conversion in clathrin-mediated endocytic traffic," *Nature* **552**:410 (2017).

N. Perunov, R. Marsland III and J. England, "Statistical Physics of Adaptation," *Phys. Rev. X* **6**:021036 (2016).

R. Marsland III and J. England, "Far-from-equilibrium distribution from near-steady-state work fluctuations," *Phys. Rev. E* **92**(5):052120 (2015).

R. Marsland III, H.R. Brown, and G. Valente, "Time and irreversibility in axiomatic thermodynamics," *American Journal of Physics* **83**(7):628-634 (2015).

T. Bhamre, R. Marsland III, I.K. Kominis, B.H. McGuyer, and W. Happer, "Collision Kernels from Velocity-Selective Optical Pumping with Magnetic Depolarization," *Phys. Rev. A* **87**(4):043412 (2013).

R. Marsland III, B. H. McGuyer, B. A. Olsen, and W. Happer, "Spin-velocity correlations of optically pumped atoms," *Phys. Rev. A* **86**(2):023404 (2012).

B. H. McGuyer, R. Marsland III, B. A. Olsen, and W. Happer, "Cusp Kernels for Velocity-Changing Collisions," *Phys. Rev. Lett.* **108**(18):183202 (2012).

N. Kostinski, B. A. Olsen, R. Marsland, B. H. McGuyer, and W. Happer, "Temperature-insensitive laser frequency locking near absorption lines," *Rev. Sci. Instr.* **82**(3):033114 (2011).