ROBERT MARSLAND III

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Education

Doctor of Philosophy in Physics *2017*
Massachusetts Institute of Technology

Master of Studies in Philosophy of Physics *2012*
Oxford University, Oxford, UK
Distinction

Bachelor of Arts in Physics; Certificate in Latin Language and Literature *2011*
Princeton University, Princeton, NJ
Summa cum laude, GPA 3.9

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*
Allen G. Shenstone Prize in Physics for excellence and promise in independent research *2010, 2011*
Rhodes Scholarship Finalist *2010*
Manfred Pyka Memorial Physics Prize for outstanding progress in first-year physics courses *2008*
Shapiro Prize for outstanding academic achievement in first and second-year studies *2009*

Teaching Experience

Lecturer, *Intermediate Mechanics (PY408)* *2018*
Boston University
Designed and presented lectures, homework and exams

Media Arts and Sciences (MAS) Facilitator *2013 - 2014*
Massachusetts Institute of Technology
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.

Graduate Teaching Assistant, *Introduction to Classical Mechanics (8.01)* *2013*
Massachusetts Institute of Technology
Managed a team of five undergraduate teaching assistants to facilitate three hours of Technology Enabled Active Learning classes per week.

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

Journals Refereed

Physical Review Letters, Physica A, Physical Review E, American Journal of Physics, PLOS One, PLOS Computational Biology, Ecology Letters

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

Publications

In Preparation

R. Marsland III, W. Cui, A. Murugan and P. Mehta, "Ecology for Physicists."

F.S. Valdovinos and R. Marsland III, "Biodiversity and ecosystem services in a mechanistic model of plant/pollinator interactions."

F.S. Valdovinos and R. Marsland III, "Criteria for alien plant invasiveness in a mechanistic model of plant/pollinator interactions."

R. Marsland III, W. Cui and P. Mehta, "A cavity solution to the Microbial Consumer Resource Model."

Published/Preprints

R. Marsland III, A. Mayer, O. Howell and P. Mehta, "Adaptive immunity as a computing ecosystem: optimization and self-organized robustness in Treg-mediated self tolerance." (2020).

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).

F.S. Valdovinos and R. Marsland III, "Niche theory for mutualism: A graphical approach to plant-pollinator network dynamics." *arXiv*:2002.04484 (2020).

W. Cui, R. Marsland III and P. Mehta, "The effect of resource dynamics on species packing in diverse ecosystems." *arXiv*:1911.02595 (2019).

O. Howell, W. Cui, R. Marsland III and P. Mehta, "Machine learning as ecology." *arXiv*:1908.00868 (2019).

W. Cui, R. Marsland III and P. Mehta, "Diverse communities behave like typical random ecosystems." *arXiv*:1904.02610 (2019).

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