ROBERT MARSLAND III

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Positions

Visiting Scholar *2023 - present*
Environmental Science & Policy, University of California, Davis

Postdoctoral Scholar *2017 - 2020*
Theoretical Biophysics Group, Department of Physics, Boston University

Education

Licentiate of Sacred Theology *2024*
Pontifical University of the Holy Cross, Rome, Italy

Bachelor of Sacred Theology *2022*
Pontifical University of the Holy Cross, Rome, Italy

Doctor of Philosophy in Physics *2017*
Massachusetts Institute of Technology, Cambridge, MA

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

Teaching

De Deo Uno et Trino II *2024*
Studium Generale Praelaturae Sanctae Crucis et Operis Dei
Designed and implemented an interactive intensive course covering the second semester of Trinitarian theology in the Pontifical STB curriculum

Intermediate Mechanics *2018*
Boston University
Designed and presented lectures, homework and exams

Introduction to Classical Mechanics *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

Natural Contemplation in the *Quaestiones ad Thalassium*
Workshop on St. Maximus the Confessor's Christian Philosophy
XIX International Conference on Patristic Studies at Oxford
August 7, 2024

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
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

***Naturam totam complectari animo*: Towards a relational ecology** *Summer 2024*

Pontifical University of the Holy Cross
Organized a half-day workshop with six invited participants from science and philosophy faculties in five different countries, examining the kinds of ontology implicitly deployed in contemporary ecological theory, in dialogue with the *logos*-ontology of Maximus the Confessor.
Co-organizers: Dr. Douglas Sponsler (U. Würzburg), Prof. Giulio Maspero

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

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

Publications

Z. Feng, R. Marsland III, J. W. Rocks and P. Mehta, "Emergent competition shapes top-down versus bottom-up control in multi-trophic ecosystems." *PLoS Comp. Biol.* **20**(2) (2024).

W. Cui, R. R Marsland III and P. Mehta, "From niche theory to statistical mechanics," *Lecture Notes of the Les Houches Summer School* (2023).

R. Marsland III, "Sacramental penance as existential liberation in Hildegard von Bingen's *Liber Vitae Meritorum*." *Annales Theologici* **37**(1):235 (2023).

F. S. Valdovinos, S. Dritz and R. Marsland III, "Transient dynamics in plant-pollinator networks: fewer but higher quality of pollinator visits determines plant invasion success." *Oikos* **2023**(6):e09634 (2023).

J. C. C. Vila, J. Goldford, S. Estrela, D. Bajic, A. Sanchez-Gorostiaga, A. Damian-Serrano, N. Lu, R. Marsland III, M. Rebolleda-Gomez, P. Mehta and A. Sanchez, "Metabolic similarity and the predictability of microbial community assembly. *bioRxiv*:2023.10.25.564019 (2023).

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. 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).