Curriculum Vitae

Prajwal Padmanabha

Postdoctoral Researcher,
Department of Fundamental
Microbiology,
University of Lausanne,
Switzerland

Email:
pprajwal122@gmail.com
prajwal.padmanabha@unil.ch
Website: https://prajwalp.github.io/

Education

2024 –	Postdoc at the Mitri Lab, Department of Fundamental Microbiology, University of Lausanne, Switzerland
2020–2024	PhD in Physics, LIPh Lab, Department of Physics, University of Padua, Italy
2015–2020	Integrated BS-MS at Indian Institute of Science Education and Research, Kolkata, India

PhD

Feb 2024 - (current)

Postdoctoral researcher - Microbial Ecology
Dr. Sara Mitri — University of Lausanne

Studies in field and theoretical ecology have constantly been baffled by the degree of diversity observed. Theoretical models of species dynamics typically places stringent constraints on possible degree of coexistence which is at odds with observations in nature. Different mechanisms of coexistence have been proposed, from obligate dependencies to temporal niches. I am currently working, both through theory and experiments, on bridging different theories of species dynamics to understand the correspondence between observed levels of coexistence and how to improve it.

Sep 2020 - Jan 2024

PhD in Physics cum laude
Fluctuations across statistical scales: from statistical physics theory to biological applications
Dr. Amos Maritan and Dr. Sandro Azaele — University of Padua

I worked on non-equilibrium statistical mechanics with two main directions of research. On the theoretical side, on exploring the effects of perturbation in different kinds of systems, with emphasis on systems with absorbing states. These kinds of systems are important non-equilibrium systems and appear frequently in biological and chemical examples. Therefore, it is crucial to investigate on two levels - the properties of such systems and the response to perturbations. Tangentially, I also worked on applying tools of statistical mechanics to ecological and microbial model systems. This mainly features the use of a stochastic dynamics framework to model forests and microbial communities. Specifically, I generalized a seminal and phenomenological version of metapopulation model with extensions to multiple species and emergence of coexistence due to habitat preferences.

Publications

2023   *Emergent encoding of dispersal network topologies in spatial metapopulation models*
Giorgio Nicoletti*, **Prajwal Padmanabha***, Sandro Azaele, Samir Suweis, Andrea Rinaldo, Amos Maritan
Proceedings of National Academy of Sciences - DOI: 10.1073/pnas.2311548120

Generalization of Fluctuation-Dissipation Theorem to Systems with Absorbing States
Prajwal Padmanabha, Sandro Azaele, Amos Maritan
New Journal of Physics - DOI: 10.1088/1367-2630/ad0616

Fluctuations of entropy production of a run-and-tumble particle
Prajwal Padmanabha, Daniel Busiello, Amos Maritan, Deepak Gupta
Physical Review E - DOI: 10.1103/PhysRevE.107.014129

Conferences and Workshops

May 2023   **Workshop on Signatures of Nonequilibrium Fluctuations in Life — ICTP Trieste**

December 2022   **(Post)modern Thermodynamics — Luxembourg**

June 2022   **Eco-evolutionary dynamics of microbial communities — ICTP Trieste**

January 2022   **Winter Workshop on Complex Systems — Besançon, France**

Organizational Activities

May 2024   **Stochastic Models and Experiments in Ecology and Biology — L'Aquila, Italy**
Co-Organizer

May 2024   **Pint of Science — Lausanne, Switzerland**
Local Organizer

June 2024   **Evolution 2024 Watch Session — Lausanne, Switzerland**
Co-Organizer

Other Research Experience

August 2019 - 2020   **Masters Thesis - Collective Dynamics: Long range order of Self Propelled Particles in heterogeneous media**
Dr. Rumi De — IISER Kolkata

Collective ordered motion (flocking in common terms) is seen in nature frequently. Efforts to explain this through simple rules have been an ongoing endeavour for the past few decades. Simple models with Self Propelled Particles (SPPs) have demonstrated flocking behaviour and also show phase transitions similar to ones in statistical physical systems. Taking these models a step further, we introduced heterogeneity in the medium through the placement of obstacles (similar to a herd of deer encountering a tree or a school of fish encountering a rock). We tried to understand how obstacles affect the dynamics of the system and what specific properties (geometry, area, number etc.) of obstacles are more important than others.

Teaching Assistant-ship

Autumn 2023	**Models of Theoretical Physics** Introduction to various theoretical approaches to describe mesoscopic and macroscopic phenomena in physics
Spring 2023	**Statistical Mechanics of Complex Systems** Introduction to the use of statistical mechanics methods for use in various complex systems, including biological examples
Spring 2020	**Research Methodology** Brief overview of the history and philosophy of science and includes hypothesis testing, model formulation, ethics in science and other such topics.
Fall 2019	**Computational Physics** Exposure to techniques for solving differential equations, matrix equations and simulation of non-equilibrium processes.