Gianmarco Spera

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Research interest

I am a Ph.D. student in the Theory of Complex Systems group at the Laboratoire Matière et Systèmes Complexes, MSC Lab. There, I work under the supervision of Marc Durand, François Graner, and Julien Tailleur. I am interested in statistical mechanics and its application to biological systems. In particular, my work focuses on studying, both theoretically and analytically, the emerging physics of active systems starting from their microscopic description.

Education

Ph.D. student in theoretical physics **2020 - now**
Université Paris Cité, Laboratoire Matière et Systèmes Complexes
Thesis: Are biological cells just another type of active particles? Supervisors: Marc Durand, François Graner, and Julien Tailleur.

Master Degree in Physics **2020**
University of Rome La Sapienza, Grade: 110/110 cum laude
Thesis title: Statistical analysis and theoretical modeling of swarming behavior in mosquitoes. Thesis advisor: Irene Giardina.

Bachelor Degree in Physics **2018**
University of Rome La Sapienza, Grade: 110/110 cum laude
Thesis title: Critical phenomena and Ising model. Thesis advisor: Mauro Lucio Papinutto.

Research experience

Ph.D. student in theoretical physics *Université Paris Cité* **2020 - now**
Under the supervision of Marc Durand, François Graner, and Julien Tailleur, I am working on the comparison between active particles and biological cells. To tackle the question we started by looking at the emerging physics of particles based model when activity interplays with pairwise interactions and aligning torques. Currently, we are studying mechanical properties of cellular model to compare them with particles one.

Master thesis in CoBBS Lab *University of Rome La Sapienza* **2020**
In the Collective Behaviour in Biological Systems (CoBBS) lab, under the supervision of Irene Giardina, I studied the swarm and mating behavior of *Anophele Gambiae* mosquitoes. We provided a statistical characterization of their swarming behavior and proposed an experimental based model for their dynamics.

Laboratory Project *University of Rome La Sapienza* **2019**
Under the supervision of Claudio Conti and Davide Pierangeli, we studied light focusing in disordered media. Using neural networks techniques, we managed to use a sample of brain tumor as a lens.

Teaching activity

TP Mechanics **2022-now**
IUT Paris Pajol

TD Real analysis **2019-2020**
University of Rome La Sapienza

Awards

Excellence Programme in Physics **2017**
Classes: Real Analysis, Potential theory, classical gravity, and critical phenomena.

Skills

Languages: Italian: Native language. English: Advanced. French: Advanced
Programming: C, C++, Python, Matlab, awk, bash, and Mathematica.

Talks, Conferences, and Summer Schools

2023

Physics of Living Systems MIT. Cambridge (USA). Seminar.
Statphys28. Tokyo (Japan). Contributed talk.
Perspectives on Non-Equilibrium Statistical Mechanics. Kyoto (Japan). Poster presentation.
Yukawa Institute for Theoretical Physics. Kyoto (Japan). Seminar.
Frontiers in nonequilibrium physics. Kyoto (Japan). Poster presentation.
AMSCE. Dresden (Germany). Poster presentation.
Laboratoire Matière et Systèmes Complexes. Paris (France). Seminar.
Journées de Physique Statistique. Paris (France). Contributed talk.

2022

Active Matter: The Next 25 Years 2022. Leiden (Netherlands). Poster presentation.
EDPIF. Paris (France). Contributed talk.
MSC non-permanents. Paris (France). Contributed talk.
New frontiers in liquid matter. Paris (France). Poster presentation.
Disorder in complex systems. Paris (France). Summer school.
APS March meeting. Chicago (USA). Contributed talk.

2021

Multiscale integration in biological systems. Paris (France) . Flash talk.
News from Disordered Elastic Systems. Spetses (Greece). Conference.
Fundamental problems in statistical Physics. Brunico (Italy). Summer school.
Glassy systems and inter-disciplinary applications. Cargèse (France). Summer school.

Publications

[1] Gianmarco Spera, Charlie Duclut, Marc Durand, and Julien Tailleur. Nematic torques in scalar active matter: when fluctuations favor polar order and persistence. *arXiv preprint arXiv:2301.02568*, 2023.