

Étienne Fodor

Physics of Active Matter

Assistant Professor, ATTRACT Fellow

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Dept of Physics and Materials Science

University of Luxembourg

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Scientific positions and education

Since 2020 **Assistant Professor**, Dept of Physics and Materials Science, University of Luxembourg

2017–20 **Oppenheimer Research Fellow**, DAMTP, University of Cambridge

2016–17 **Postdoctoral Research Associate**, DAMTP, University of Cambridge

2013–16 **PhD in Theoretical Physics**, Université Paris Diderot | Summa cum laude
“Tracking nonequilibrium in living matter and self-propelled systems”
Supervisors | P Visco, F van Wijland

2012–13 **Master in Physics – 2nd year**, École Normale Supérieure de Paris
ICFP - Macroscopic Physics and Complexity

2011–12 **Agrégation de Physique**, École Normale Supérieure de Cachan
Competitive training for teaching Physics at College level

2010–11 **Master in Physics – 1st year**, École Normale Supérieure de Lyon

2009–10 **Bachelor in Physics**, École Normale Supérieure de Lyon

Research, supervision and teaching experience

Since 2021 **Masters lecture**, Dept of Physics and Materials Science, University of Luxembourg
“Nonequilibrium soft and active matter” | 14 weeks

Since 2020 **Group supervision**, Dept of Physics and Materials Science, University of Luxembourg
Postdocs | LK Davis, A Manacorda, WD Pineros, T Banerjee
PhD students | Y Zhang, A Tanaji Mohite, L Casagrande

Since 2020 **PhD committees**, Dept of Physics and Materials Science, University of Luxembourg
Student (Supervisor) | E Penocchio, S Gopal, M Bilancioni, D Forastiere (M Esposito),
J Ekström, K Wu, Byjesh NR (T Schmidt), N Carabba (A del Campo), S Martina (A Skupin),
B Ames, V Vassilev Galindo, A Kokorin (A Tkatchenko), N Hörnedal (A Chenu)

2017–20 **PhD co-supervision**, DAMTP, University of Cambridge
Students | ØL Borthne, T Ekeh

2019–20 **Part III project supervision**, DAMTP, University of Cambridge | 8 months
Part III student | JW Knight (University of Cambridge) | BP Nevill Mott Prize

2019 **Research visit** James Franck Institute, University of Chicago | 2 weeks
Host researcher | S Vaikuntanathan

2017–18 **Part III project supervision**, DAMTP, University of Cambridge | 8 months
Part III student | T Ekeh (University of Cambridge)

2016–17 **Internship supervision**, DAMTP, University of Cambridge | 5 months
Master student | D Martin (École Normale Supérieure de Paris)

2015–16 **Research visit**, YITP, Kyoto University | 2 months/year
Host researcher | H Hayakawa

2013–16 **Tutorials in medical Physics**, Université Paris Diderot | 64 hours/year

2013 **Master internship – 2nd year**, Université Paris Diderot | 16 weeks
Supervisors | P Visco, F van Wijland

2012–13 **Physics tutorials at College level**, Lycée Fénélon, Paris | 23 hours

2011 **Master intership – 1st year**, University of Oxford | 12 weeks
Supervisors | AS Wyatt, IA Walmsley

2010–11 **Physics tutorials at College level**, Lycée la Martinière Monplaisir, Lyon | 60 hours

2010 **Bachelor internship**, Université de Genève | 8 weeks
Supervisors | J Extermann, L Bonacina, J-P Wolf

Fundings, fellowships, and awards

- 2020–25 **ATTRACT Fellowship**, Fonds National de la Recherche, Luxembourg
- 2020–24 **Doctoral Training Unit Active**, Fonds National de la Recherche, Luxembourg
Project leader | Massimiliano Esposito
- 2017–20 **Oppenheimer Research Fellowship**, University of Cambridge
Junior Research Fellowship, St Catharine’s College, Cambridge
- 2017 **PhD prize**, Institut des Systèmes Complexes, Paris (3rd prize)
Best talk prize, SIAM-IMA Annual Conference, University of Cambridge
- 2015 **Best talk prize**, Active Liquids Conference, Lorentz Center, Leiden University
- 2013–16 **Teaching Assistantship**, Université Paris Diderot
PhD Scholarship, École Normale Supérieure de Cachan
- 2011–13 **Master Scholarship**, École Normale Supérieure de Cachan

Scientific presentations, organized events, and review service

Invited conference talks

- 2022 **Statistical Mechanical Theories of Emergence in Biological Systems**, Higgs Centre for Theoretical Physics, Edinburgh
Numerical Techniques for Nonequilibrium Steady States, CECAM, Mainz
- 2020 **Symmetry, Thermodynamics and Topology in Active Matter**, KITP (online)
- 2018 **Why Measure Entropy Production?**, Princeton University
Active Matter Session, University of California, Berkeley

Contributed conference talks

- 2021 **Liquid Matter Conference**, Prague (online)
Workshop on Stochastic Thermodynamics II, Sante Fe (online)
- 2020 **Motile Active Matter Conference**, Bonn (online)
- 2019 **StatPhys, Out-of-equilibrium aspects**, Buenos Aires
International Soft Matter Conference, Edinburgh
Statistical Physics of Complex Systems, Nordita, Stockholm
- 2018 **Nonequilibrium Collective Dynamics**, Technische Universität Berlin
Fundamental Problems in Active Matter, Aspen Center for Physics
- 2017 **SIAM-IMA Annual Conference**, University of Cambridge
Edwards Centre Mini Conference, University of Cambridge
Open Statistical Physics, Milton Keynes
- 2016 **StatPhys, Biological Physics**, Lyon
Non-Gaussian Workshop, Kyoto University
- 2015 **Lorentz Center, Active Liquids**, Leiden University
- 2014 **Condensed Matter in Paris**, Université Paris Descartes
ESPCI, Journées de Physique Statistique, Paris

Invited seminars

- 2022 **Biological Physics and Physical Biology**, online
DAMTP, Soft Matter Seminar, University of Cambridge (online)
Mathematical Physics Seminar, Imperial College London (online)
- 2021 **Department of Physics, Guangdong Technion** (online)
Quantum Science and Technology, University of Luxembourg (online)
Non-equilibrium Statistical Physics, Georg-August-Universität Göttingen (online)
Centre de Physique Théorique, Aix-Marseille Université (online)
- 2020 **School of Physics and Astronomy**, University of Edinburgh (online)
Department of Physics, University of Bath
- 2019 **ICTP, Quantitative Life Sciences Group**, Trieste

- James Franck Institute, Department of Chemistry, University of Chicago
 Physics of Living Systems, Massachusetts Institute of Technology
 Physics and Materials Science Research Unit, University of Luxembourg
 Institute of Physics, Computational Soft Matter, University of Amsterdam
- 2018 LiPhy Laboratory, Université Grenoble Alpes
 Charles Coulomb Laboratory, Université de Montpellier
 ESPCI, Gulliver Laboratory, Paris
 St Catharine's College, Graduate Research Seminars, Cambridge
 Research Colloquium Series, California State University, Fullerton
- 2017 DAMTP, Soft Matter Seminar, University of Cambridge
 DAMTP, BioLunch Seminar, University of Cambridge
- 2016 School of Mathematical Sciences, Queen Mary University of London
 DAMTP, Soft Matter Seminar, University of Cambridge
 MSC Laboratory Seminar, Université Paris Diderot
 Yukawa Institute for Theoretical Physics, Kyoto University
- 2015 LiPhy Laboratory, Université Grenoble Alpes
 Physics-Biology Interface Seminar, Université Paris Sud
 DAMTP, Soft Matter Seminar, University of Cambridge
 Yukawa Institute for Theoretical Physics, Kyoto University
- 2014 MSC Laboratory, Physique du vivant, Université Paris Diderot
 MSC Laboratory, Theory Group, Université Paris Diderot
- Organized events**
- 2024 Energy, Information and Evolution in Biology, Summer school, Cargèse
- 2018–20 Statistical Physics and Soft Matter Seminars, DAMTP, University of Cambridge
- 2019 Colloids as a Toolbox for Statistical Mechanics, University of Cambridge
- 2018 World Congress of Biomechanics, Non-equilibrium Biomechanics session, Dublin
- Review service** Commun Phys, EPL, EPJE, J Chem Phys, J Phys A, J Stat Mech, Nat Commun, Nat Phys, New J Phys, Phys Rev (E, Lett, Res, X), PNAS, Sci Adv, Sci Rep | ca 10 papers/year

Scientific production

- [33] **Pulsating active matter**
 Y Zhang and ÉF, arXiv:2208.06831
- [32] **Thermodynamic control of activity patterns in cytoskeletal networks**
 A Lamtyugina, Y Qiu, ÉF, AR Dinner, and S Vaikuntanathan, Phys. Rev. Lett. **129**, 128002 (2022)
- [31] **From predicting to learning dissipation from pair correlations of active liquids**
 G Rassolov, L Tociu, ÉF, and S Vaikuntanathan, J. Chem. Phys. **157**, 054901 (2022)
- [30] **Mean-field theory for the structure of strongly interacting active liquids**
 L Tociu, G Rassolov, ÉF, and S Vaikuntanathan, J. Chem. Phys. **157**, 014902 (2022)
- [29] **Power fluctuations in sheared amorphous materials: A minimal model**
 T Ekeh, ÉF, SM Fielding, and ME Cates, Phys Rev E **105**, L052601 (2022)
- [28] **Irreversibility and biased ensembles in active matter: Insights from stochastic thermodynamics**
 ÉF, RL Jack, and ME Cates, Annu Rev Condens Matter Phys **13**, 215 (2022)
- [27] **Stochastic hydrodynamics of complex fluids: Discretisation and entropy production**
 ME Cates, ÉF, C Nardini, T Markovich, and E Tjhung, Entropy **24**, 254 (2022)
- [26] **Optimal power and efficiency of odd engines**
 ÉF and A Souslov, Phys. Rev. E **104**, L062602 (2021)
- [25] **Thermodynamics of active field theories: Energetic cost of coupling to reservoirs**
 T Markovich, ÉF, E Tjhung, and ME Cates, Phys Rev X **11**, 021057 (2021)

- [24] **Active engines: Thermodynamics moves forward**
ÉF and ME Cates, EPL **134**, 10003 (2021)
- [23] **Statistical mechanics of active Ornstein-Uhlenbeck particles**
D Martin, J O’Byrne, ME Cates, ÉF, C Nardini, J Tailleur, and F van Wijland, Phys Rev E **103**, 032607 (2021)
- [22] **Collective motion in large deviations of active particles**
Y-E Keta, ÉF, F van Wijland, ME Cates, and RL Jack, Phys Rev E **103**, 022603 (2021)
- [21] **Time-reversal symmetry violations and entropy production in field theories of polar active matter**
ØL Borthne, ÉF, and ME Cates, New J Phys **22**, 123012 (2020)
- [20] **Thermodynamic cycles with active matter**
T Ekeh, ME Cates, and ÉF, Phys Rev E **102**, 010101(R) (2020)
- [19] **Dissipation controls transport and phase transitions in active fluids: Mobility, diffusion and biased ensembles**
ÉF, T Nemoto, and S Vaikuntanathan, New J Phys **22**, 013052 (2020)
- [18] **Autonomous engines driven by active matter: Energetics and design principles**
P Pietzonka, ÉF, C Lohrmann, ME Cates, and U Seifert, Phys Rev X **9**, 041032 (2019)
- [17] **How dissipation constrains fluctuations in nonequilibrium liquids: Diffusion, structure and biased interactions**
L Tociu, ÉF, T Nemoto, and S Vaikuntanathan, Phys Rev X **9**, 041026 (2019)
- [16] **Driven probe under harmonic confinement in a colloidal bath**
V Démery and ÉF, J Stat Mech **2019**, 033202 (2019)
- [15] **Optimizing active work: Dynamical phase transitions, collective motion and jamming**
T Nemoto, ÉF, ME Cates, RL Jack, and J Tailleur, Phys Rev E **99**, 022605 (2019)
- [14] **Non-Gaussian noise without memory in active matter**
ÉF, H Hayakawa, J Tailleur, and F van Wijland, Phys Rev E **98**, 062610 (2018)
- [13] **The statistical physics of active matter: From self-catalytic colloids to living cells**
ÉF and M Cristina Marchetti, Physica A **504**, 106 (2018)
- [12] **Extracting maximum power from active colloidal heat engines**
D Martin, C Nardini, ME Cates, and ÉF, EPL **121**, 60005 (2018)
Editor’s choice | Highlights of 2018
- [11] **Active mechanics reveal molecular-scale force kinetics in living oocytes**
WW Ahmed,* ÉF,* M Almonacid,* M Bussonnier, NS Gov, M-H Verlhac, P Visco, F van Wijland, and T Betz, Biophys J **114**, 1667 (2018)
- [10] **Spatial fluctuations at vertices of epithelial layers: Quantification of regulation by Rho pathway**
ÉF,* V Mehandia,* J Comelles, R Thiagarajan, NS Gov, P Visco, F van Wijland, D Riveline
Biophys J **114**, 939 (2018)
- [9] **Entropy production in field theories without time-reversal symmetry: Quantifying the non-equilibrium character of active matter**
C Nardini, ÉF, E Tjhung, F van Wijland, J Tailleur, and ME Cates, Phys Rev X **7**, 021007 (2017)
- [8] **Nonequilibrium dissipation in living oocytes**
ÉF,* WW Ahmed,* M Almonacid,* M Bussonnier, NS Gov, M-H Verlhac, T Betz, P Visco, and F van Wijland, EPL **116**, 30008 (2016)
- [7] **How far from equilibrium is active matter?**
ÉF, C Nardini, ME Cates, J Tailleur, P Visco, and F van Wijland, Phys Rev Lett **117**, 038103 (2016)
Editor’s suggestion | Physics (2016)
- [6] **Active cage model of glassy dynamics**
ÉF, H Hayakawa, P Visco, and F van Wijland, Phys Rev E **94**, 012610 (2016)

- [5] **Modeling the dynamics of a tracer particle in an elastic active gel**
E Ben Isaac, ÉF, P Visco, F van Wijland, and NS Gov, Phys Rev E **92**, 012716 (2015)
 - [4] **Active cell mechanics: Measurement and theory**,
WW Ahmed, ÉF, and T Betz, Biochimica et Biophysica Acta - Mol Cell Res **1853**, 3083 (2015)
 - [3] **Activity-driven fluctuations in living cells**
ÉF,* M Guo,* NS Gov, P Visco, DA Weitz, and F van Wijland, EPL **110**, 48005 (2015)
Editor's choice | Europhysics News 46/5 (2015)
 - [2] **Generalized Langevin equation with hydrodynamic backflow: Equilibrium properties**
ÉF, DS Grebenkov, P Visco, and F van Wijland, Physica A **422**, 107 (2015)
 - [1] **Energetics of active fluctuations in living cells**
ÉF, K Kanazawa, H Hayakawa, P Visco, and F van Wijland, Phys Rev E **90**, 042724 (2014)
- * Equal contribution of these authors to this work