Étienne Fodor

Physics of Active Matter
Assistant Professor, ATTRACT Fellow
etienne.fodor@uni.lu | efodorphysics.github.io

Dept of Physics and Materials Science
Univ of Luxembourg
162a, avenue de la Faïencerie
L-1511 Luxembourg

Scientific positions and education

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

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

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

2013–16 **PhD in Theoretical Physics**, Univ 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 **Master lecture**, Dept of Physics and Materials Science, Univ of Luxembourg
"Nonequilibrium soft and active matter" | 14 weeks/year

Since 2020 **Group supervision**, Dept of Physics and Materials Science, Univ of Luxembourg
Postdocs | LK Davis, A Manacorda, WD Pineros, T Banerjee, UA Dattani, F Serafin
PhD students | Y Zhang, L Casagrande, IJC Miranda
Master students | L Casagrande, T Desaleux

Since 2020 **PhD committees**, Dept of Physics and Materials Science, Univ of Luxembourg
Student (Supervisor) | E Penocchio, S Gopal, M Bilancioni, D Forastiere (M Esposito), J Ekström, K Wu, BN Radhakrishnan (T Schmidt), L Dupays, N Carabba (A del Campo), S Martina (A Skupin), B Ames, V Vassilev Galindo, A Kokorin, N Davoine (A Tkatchenko), N Hörnedal (A Chenu)
Other committees | Z Zhang (Supervisor: G Pruessner, Imperial College), L Guislain (Supervisor: E Bertin, Univ Grenoble Alpes)

2017–20 **PhD co-supervision**, DAMTP, Univ of Cambridge (Students: ØL Borthne, T Ekeh)

2019–20 **Part III project supervision**, DAMTP, Univ of Cambridge (Student: JW Knight) | 8 months

2017–18 **Part III project supervision**, DAMTP, Univ of Cambridge (Student: T Ekeh) | 8 months

2016–17 **Internship supervision**, DAMTP, Univ of Cambridge (Student: D Martin) | 5 months

2015–16 **Research visit**, YITP, Kyoto Univ | 2 months/year

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

2013 **Research internship**, Univ Paris Diderot (Supervisors: P Visco, F van Wijland) | 16 weeks

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

2011 **Research intership**, Univ of Oxford (Supervisors: AS Wyatt, IA Walmsley) | 12 weeks

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

2010 **Research internship**, Univ de Genève (Supervisors: L Bonacina, J-P Wolf) | 8 weeks

Fundings, fellowships, and awards

2024–27 **CORE grant**, Fonds National de la Recherche, Luxembourg

2020–25 **ATTRACT Fellowship**, Fonds National de la Recherche, Luxembourg

2017–20 **Oppenheimer Research Fellowship**, Univ 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, Univ of Cambridge

2015 **Best talk prize**, Active Liquids Conference, Lorentz Center, Leiden Univ

2013–16 **Teaching Assistantship**, Univ 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

2023 **Frontiers in Nonequilibrium Physics: Active Matter, Topology and Beyond**, Kyoto
Conference on Statistical Mechanics, Sitges
Physics of Dense and Active Disordered Materials, Kyoto
Frontiers in Nonequilibrium Physics, Institute of Mathematical Sciences, Chennai

2022 **Statistical Mechanical Theories of Emergence in Biological Systems**, 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 Univ
Active Matter Session, Univ of California, Berkeley

Contributed conference talks

2024 **Energy, Information and Evolution in Biology**, Cargèse
DPG Spring Meeting, Berlin

2023 **Computational Advances in Active Matter**, Lorentz Center, Leiden
StatPhys, **Soft Matter**, Tokyo
Bridge between Non-equilibrium Statistical Physics and Biology, Cambridge
New Perspectives in Active Systems, Dresden
From Soft Matter to Biophysics, Les Houches

2021 **Liquid Matter Conference**, Prague (online)
Workshop on Stochastic Thermodynamics II (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 Univ Berlin
Fundamental Problems in Active Matter, Aspen Center for Physics

2017 **SIAM-IMA Annual Conference**, Univ of Cambridge
Edwards Centre Mini Conference, Univ of Cambridge
Open Statistical Physics, Milton Keynes

2016 **StatPhys**, **Biological Physics**, Lyon
Non-Gaussian Workshop, YITP, Kyoto

2015 **Active Liquids**, Lorentz Center, Leiden

2014 **Condensed Matter in Paris**, Univ Paris Descartes
ESPCI, **Journées de Physique Statistique**, Paris

Invited seminars

2024 **Niels Bohr Institute**, Univ of Copenhagen
Institute of Physics, Univ of Leiden

2023 **Biological, Soft and Complex Materials and Theory Seminar**, Univ of Bristol
EMBL Theory Seminar, Heidelberg

2022 **Biological Physics and Physical Biology**, online
DAMTP, **Soft Matter Seminar**, Univ of Cambridge (online)

Mathematical Physics Seminar, Imperial College London (online)

2021 **Department of Physics**, Guangdong Technion (online)
Quantum Science and Technology, Univ of Luxembourg (online)
Non-equilibrium Statistical Physics, Georg-August-Univ Göttingen (online)
Centre de Physique Théorique, Aix-Marseille Univ (online)

2020 **School of Physics and Astronomy**, Univ of Edinburgh (online)
Department of Physics, Univ of Bath

2019 **ICTP**, **Quantitative Life Sciences Group**, Trieste
James Franck Institute, **Department of Chemistry**, Univ of Chicago
Physics of Living Systems, Massachusetts Institute of Technology
Physics and Materials Science Research Unit, Univ of Luxembourg
Institute of Physics, **Computational Soft Matter**, Univ of Amsterdam

2018 **LiPhy Laboratory**, Univ Grenoble Alpes
Charles Coulomb Laboratory, Univ de Montpellier
ESPCI, **Gulliver Laboratory**, Paris
St Catharine's College, **Graduate Research Seminars**, Cambridge
Research Colloquium Series, California State Univ, Fullerton

2017 **DAMTP**, **Soft Matter Seminar**, Univ of Cambridge
DAMTP, **BioLunch Seminar**, Univ of Cambridge

2016 **School of Mathematical Sciences**, Queen Mary Univ of London
DAMTP, **Soft Matter Seminar**, Univ of Cambridge
MSC Laboratory Seminar, Univ Paris Diderot
Yukawa Institute for Theoretical Physics, Kyoto

2015 **LiPhy Laboratory**, Univ Grenoble Alpes
Physics-Biology Interface Seminar, Univ Paris Sud
DAMTP, **Soft Matter Seminar**, Univ of Cambridge
Yukawa Institute for Theoretical Physics, Kyoto

2014 **MSC Laboratory**, **Physique du vivant**, Univ Paris Diderot
MSC Laboratory, **Theory Group**, Univ Paris Diderot

Organized events

2024 **Energy, Information and Evolution in Biology**, Summer school, Cargèse

2018–20 **Statistical Physics and Soft Matter Seminars**, DAMTP, Univ of Cambridge

2019 **Colloids as a Toolbox for Statistical Mechanics**, Univ of Cambridge

2018 **World Congress of Biomechanics**, **Non-equilibrium Biomechanics session**, Dublin

Review service

Journals | 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, Science, Sci Adv, Sci Rep, Soft Matter (ca 10 papers/year)
Research agencies | Israel Science Foundation, Deutsche Forschungsgemeinschaft

Scientific production

[38] **Thermodynamically consistent flocking: From discontinous to continuous transitions**
T Agranov, RL Jack, ME Cates, and ÉF, arXiv:2401.09901

[37] **Pulsating with discrete symmetry**
A Manacorda and ÉF, arXiv:2310.14370

[36] **Active matter under control: Insights from response theory**
LK Davis, K Proesmans, and ÉF, Phys Rev X (2024), in press

[35] **Pulsating active matter**
Y Zhang and ÉF, Phys Rev Lett **131**, 238302 (2023)

[34] **Non-ideal reaction-diffusion systems: Multiple routes to instability**
T Aslyamov, F Avanzini, ÉF, and M Esposito, Phys Rev Lett **131**, 138301 (2023)

[33] **Towards a liquid-state theory for active matter**
YI Li, R Garcia-Millan, ME Cates, and ÉF, EPL **142**, 57004 (2023)

[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 MC 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