Étienne Fodor

Physics of Active Matter
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Dept of Physics and Materials Science (DPhyMS)
Univ of Luxembourg
30, Avenue des Hauts-Fourneaux
L-4362 Esch-sur-Alzette, Luxembourg

Scientific positions and education

Since 2025 **Associate Professor**, DPhyMS, Univ of Luxembourg

2020–25 **Assistant Professor**, DPhyMS, Univ of Luxembourg

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

2016–17 **Postdoctoral Research Associate**, DAMTP, Univ of Cambridge (Supervisor: ME Cates)

2013–16 **PhD in Physics**, Univ Paris Diderot (Supervisors: P Visco, F van Wijland), summa cum laude

2012–13 **Masters (2nd year) in Physics**, École Normale Supérieure (ENS), Paris

2011–12 **Agrégation de Physique**, Training program for teaching in Physics Bachelors, ENS Cachan

2009–11 **Bachelors + Masters (1st year) in Physics**, ENS Lyon

Research, supervision, and teaching

Since 2022 **Masters course in Physics**, DPhyMS, Univ of Luxembourg | 14 weeks/year

Since 2020 **Group supervision**, DPhyMS, Univ of Luxembourg
8 Postdocs | LK Davis (20–22), A Manacorda* (21–24), T Banerjee† (22–26), WD Piñeros* (22–25), UA Dattani (23–25), F Serafin (24–25), A Soriani (26–27), F Thewes (26–27)
*Marie-Curie Fellow (Horizon Europe), †CORE Junior Fellow (Luxembourg)
6 PhDs | Y Zhang (20–23), BN Radhakrishnan (21–25), L Casagrande (23–26), N Setzkorn (24–27), IJC Miranda (24–27), M Antonioli (24–27)
4 Masters | L Casagrande (22–23), T Desaleux (22–23), N Setzkorn (23–24), A Jagannathan (25–26)

2024 **Masters course in Physics**, Dept of Physics, Univ of Liège | 10 hours, 1 week

2021 **Doctoral course in Physics**, DPhyMS, Univ of Luxembourg | 6 hours, 1 day

2016–20 **Student co-supervision**, DAMTP, Univ of Cambridge (Supervisor: ME Cates)
2 PhDs | ØL Borthne (17–20), T Ekeh (18–21)
3 Masters | D Martin (16–17), T Ekeh (17–18), JW Knight (19–20, best thesis prize)

2015–16 **Research visit**, YITP, Kyoto Univ (Host: H Hayakawa) | 2 months/year

2013–16 **Bachelors tutorials in Physics**, Univ Paris Diderot | 14 weeks/year

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

2012–13 **Bachelors tutorials in Physics**, Lycée Fénelon, Paris | 30 weeks

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

2010–11 **Bachelors tutorials in Physics**, Lycée la Martinière Monplaisir, Lyon | 30 weeks

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

Funding, fellowships, and awards

2026 **Outstanding Junior Fellowship**, Institute of Advanced Studies, Tel-Aviv University

2026–29 **CORE grant**, Fonds National de la Recherche (FNR), Luxembourg | 800 kEUR

2025–28 **Innovative training network**, Horizon Europe (Program lead: R Blythe) | 1 PhD

2024–27 **CORE grant**, FNR, Luxembourg | 830 kEUR

2021–26 **Doctoral training unit**, FNR (Program lead: M Esposito) | 1 PhD

2020–25 **ATTRACT Fellowship**, FNR | 1.5 MEUR

2017–20 **Oppenheimer + Junior Research Fellowship**, St Catharine's College, Univ of Cambridge

2017 **PhD prize**, Institut Systèmes Complexes, Paris + **Best talk**, SIAM-IMA Conference, Cambridge

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

2013–16 **Teaching Assistantship**, Univ Paris Diderot + **PhD Scholarship**, ENS Cachan

Scientific events and committees

Invited conference talks

2026 **Nonequilibrium Dynamics, from Active Matter to Evolutionary Dynamics**, KITP

2025 **Statistical Physics of Living Systems**, CECAM, Lausanne
International Discussion Meeting on Relaxations in Complex Systems, Barcelona
Self-Organization Far From Equilibrium, APS March meeting, Anaheim
Machine Learning for Enhanced Sampling of Atomistic Systems, Berkeley

2024 **The Many Faces of Active Mechanics**, KITP, Santa Barbara
Nonequilibrium Statistical Physics of Complex Systems, Seoul

2023 **Computational Advances in Active Matter**, Lorentz Center, Leiden
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, Berkeley

Contributed conference talks

2026 **DPG Spring Meeting**, Dresden

2025 **Multiscale Modeling of Chemically Active Mixtures**, CECAM, Lausanne
StatPhys29, **Out-of-equilibrium Statistical Physics**, Florence
From Flocking Birds to Migrating Cells: Recent Advances in Active Matter, Leiden

2024 **Dissipative Processes in Molecular Systems**, Padova
Workshop on Stochastic Thermodynamics V (online)
DPG Spring Meeting, Berlin

2023 **StatPhys28**, **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 **StatPhys27**, **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 **StatPhys26**, **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

2026 **Center for Data Science and Complexity**, Univ of Münster
Dept of Physics, Univ of Palermo

Institute of Advanced Studies, Tel-Aviv University

2025 **Soft Condensed Matter Seminar Series**, Harvard University
Biophysics Seminar Series, Massachusetts Institute of Technology
Solitons at work, online

2024 **Dept of Chemistry**, Univ of California, Berkeley
LPTMC, Sorbonne Univ, Paris
Dept of Physics, Univ of Liège
Institute of Physics, Univ of Leiden
Niels Bohr Institute, Univ of Copenhagen

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 **Dept 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)
Dept of Physics, Univ of Bath

2019 **ICTP**, **Quantitative Life Sciences Group**, Trieste
James Franck Institute, **Dept 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

2026 **Nonequilibrium Statistical Mechanics**, Univ Paris Cité, Paris | Workshop, 1 day

2025 **Nonequilibrium Systems Under Control**, Lorentz Center, Leiden | Workshop, 1 week

2024 **Energy, Information and Evolution in Biology**, Cargèse | Summer school, 2 weeks
Physics Meets Mathematics, Univ of Luxembourg | Workshop, 1 day

2018–20 **Statistical Physics and Soft Matter**, DAMTP, Univ of Cambridge | Weekly seminar

2019 **Colloids as a Toolbox for Statistical Mechanics**, Univ of Cambridge | Workshop, 1 day

2018 **Nonequilibrium Biophysics**, **World Congress of Biomechanics**, Dublin | Session, $\frac{1}{2}$ day

Outreach activities

2024 **Outreach lecture**, Institut d'Etudes Scientifiques, Cargèse
Chercheurs à l'école, Seminar in high schools, Luxembourg

2023 **Inaugural lecture**, Faculty of Science, Technology and Medicine, Univ of Luxembourg

2022 **Student fair**, DPhyMS, Univ of Luxembourg

2021 **Open day**, DPhyMS, Univ of Luxembourg

2021–24 **Internship supervision**, High-school students, Univ of Luxembourg | 1 week/year

Review and editorial service

Since 2025 **Editorial board member**, Journal of Statistical Mechanics

Since 2016 **Reviewer for scientific journals and agencies** | ca 30 reviews/year

Journals | Commun Phys, Entropy, 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, Science Adv, Soft Matter

Agencies | ANR (France), DFG (Germany), DOE (USA), FRS-FNRS (Belgium), ISF (Israel)

2025–26 **Guest editor**, Physical Review E | Special topics: "Controlling stochastic dynamics across scales"

2025–26 **Guest editor**, New Journal of Physics | Special topics: "Statistical mechanics of active matter"

PhD committees

2026 DPhyMS, Univ of Luxembourg (Student: A Kabylda, Supervisor: A Tkatchenko)
Univ of Barcelona (Student: Y Rouzaire, Supervisor: D Levis)

2025 DPhyMS, Univ of Luxembourg (Student: SGM Srinivas, Supervisor: M Esposito)
Univ of Mons (Student: G Palumbo, Supervisor: P Damman)
DPhyMS, Univ of Luxembourg (Student: M Puleva, Supervisor: A Tkatchenko)
DPhyMS, Univ of Luxembourg (Student: BN Radhakrishnan, Supervisor: TL Schmidt)

2024 Univ Grenoble Alpes (Student: L Guislain, Supervisor: E Bertin)
Univ Paris Cité (Student: A Dinelli, Supervisor: J Tailleur)
DPhyMS, Univ of Luxembourg (Student: N Carabba, Supervisor: A del Campo)
DPhyMS, Univ of Luxembourg (Student: L Dupays, Supervisor: A del Campo)

2023 Imperial College, London (Student: Z Zhang, Supervisor: G Pruessner)

2022 DPhyMS, Univ of Luxembourg (Student: D Forastiere, Supervisor: M Esposito)
DPhyMS, Univ of Luxembourg (Student: E Penocchio, Supervisor: M Esposito)
DPhyMS, Univ of Luxembourg (Student: V Vassilev Galindo, Supervisor: A Tkatchenko)

2021 Luxembourg Centre for Systems Biomedicine (Student: S Martina, Supervisor: A Skupin)
DPhyMS, Univ of Luxembourg (Student: J Ekström, Supervisor: TL Schmidt)

Scientific production

Main publications: Phys Rev Lett [40][35][34][32][7], Phys Rev X [36][25][18][17][9], Reviews [28][24][13]

[48] **Contraction waves in pulsating active liquids: From pacemaker to aster dynamics**
T Banerjee, T Desaleux, J Ranft, and ÉF, arXiv:2509.19024

[47] **Irreversibility in scalar active turbulence: The role of topological defects**
BN Radhakrishnan,* F Serafin,* TL Schmidt, and ÉF, arXiv:2507.06073

[46] **Control of active field theories at minimal dissipation**
A Soriani, E Tjhung, ÉF, and T Markovich, arXiv:2504.19285

[45] **Hydrodynamics of pulsating active liquids**
T Banerjee, T Desaleux, J Ranft, and ÉF, arXiv:2407.19955

[44] **Entropy production rate in thermodynamically consistent flocks**
T Agranov, RL Jack, ME Cates, and ÉF, New J Phys **27**, 104602 (2025)

[43] **Quantifying dissipation in flocking dynamics: When tracking internal states matters**
K Proesmans, G Falasco, A Tanaji Mohite, M Esposito, and ÉF, Phys Rev E **112**, 024103 (2025)

[42] **Diffusive oscillators capture the pulsating states of deformable particles**
A Manacorda and ÉF, Phys Rev E **111**, L053401 (2025)

[41] **Species interconversion of deformable particles yields transient phase separation**
Y Zhang, A Manacorda, and ÉF, New J Phys **27**, 043023 (2025)

[40] **Biased ensembles of pulsating active matter**
WD Piñeros and ÉF, Phys Rev Lett **134**, 038301 (2025) | Editors' suggestion

[39] **Nonequilibrium thermodynamics of non-ideal reaction-diffusion systems: Implications for active self-organization**
F Avanzini, T Aslyamov, ÉF, and M Esposito, J Chem Phys **161**, 174108 (2024)

[38] **Controlling active matter: The need for thermodynamic consistency**
ÉF, Europhys News **55**, 20 (2024)

[37] **Thermodynamically consistent flocking: From discontinuous to continuous transitions**
T Agranov, RL Jack, ME Cates, and ÉF, New J Phys **26**, 063006 (2024)

[36] **Active matter under control: Insights from response theory**
LK Davis, K Proesmans, and ÉF, Phys Rev X **14**, 011012 (2024) | Highlight in Physics 17, 20 (2024)

[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) | Editor's choice

[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

[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 | Highlight in Physics 9, s76 (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 | Highlight in 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)