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
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Scientific positions and education

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

2020–25 **Assistant Professor + ATTRACT Fellow**, DPhyMS + Fonds National de la Recherche (FNR)

2017–20 **Oppenheimer + Junior 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, co-supervised with TL Schmidt), 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 Univ

2026–29 **CORE grant**, **OptimalControlTransition**, FNR, Luxembourg | 800 kEUR

2025–28 **Doctoral Training Network**, **CAFE-BIO**, Horizon Europe (Program lead: R Blythe) | 1 PhD

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

2021–26 **Doctoral Training Unit**, **ACTIVE**, 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**, Active Liquids, Lorentz Center, Leiden

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

PhD committees

2026 **Univ of Luxembourg**, A Kabylda* (supervisor: A Tkatchenko)
Univ of Barcelona, Y Rouzaire (supervisor: D Levis)
Tata Institute of Fundamental Research, A Bansal (supervisor: M Rao)

2025 **Univ of Luxembourg**, SGM Srinivas (supervisor: M Esposito)
Univ of Mons, G Palumbo (supervisor: P Damman)
Univ of Luxembourg, M Puleva* (supervisor: A Tkatchenko)

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

2023 **Imperial College London**, Z Zhang (supervisor: G Pruessner)

2022 **Univ of Luxembourg**, E Penocchio + D Forastiere (supervisor: M Esposito)
Univ of Luxembourg, V Vassilev Galindo (supervisor: A Tkatchenko)

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

* Head of jury for these PhD defences

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, EPJE, EPL, J Chem Phys, J Phys A, J Stat Mech, Nat Commun, Nat Phys, New J Phys, Newton, Phys Rev (E, Lett, Res, X), PNAS, Science, Science Adv, Soft Matter

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

2026 **Guest editor**, Physical Review E | Special topics: "Controlling stochastic dynamics across scales"
Co-editor: TR Gingrich (Northwestern Univ)

2026 **Guest editor**, New Journal of Physics | Special topics: "Statistical mechanics of active matter"
Co-editors: M Fruchart (ESPCI), SAM Loos (MPI Goettingen), T Markovich (Tel Aviv Univ)

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

Organized events

2026 **Nonequilibrium Statistical Mechanics**, Univ Paris Cité, Paris | Workshop, 1 day
Co-organizer: F van Wijland (Univ Paris Cité)

2025 **Nonequilibrium Systems Under Control**, Lorentz Center, Leiden | Workshop, 1 week
Co-organizers: TR Gingrich (Northwestern Univ), SAM Loos (Univ of Cambridge)

2024 **Energy, Information and Evolution in Biology**, Cargèse | Summer school, 2 weeks
Co-organizers: A Manacorda, M Esposito (Univ of Luxembourg)
Physics Meets Mathematics, Univ of Luxembourg | Workshop, 1 day

2018–20 **Statistical Physics and Soft Matter**, DAMTP, Univ of Cambridge | Weekly seminar
Co-organizers: ME Cates, RL Jack (Univ of Cambridge)

2019 **Colloids as a Toolbox for Statistical Mechanics**, Univ of Cambridge | Workshop, 1 day
Co-organizers: ME Cates, RL Jack (Univ of Cambridge)

2018 **Nonequilibrium Biophysics**, **World Congress of Biomechanics**, Dublin | Session, $\frac{1}{2}$ day
Co-organizer: D Mizuno (Kyushu Univ)

Contribution to conferences, seminars, and colloquia

Invited presentations in conferences

2026 **Nonequilibrium Dynamics, from Active Matter to Evolutionary Dynamics**, KITP
Control and Optimisation of Out-of-equilibrium Processes, Beg Rohu
SigmaPhi2026, **Statistical Physics of Complex Systems**, Kolymbari
Frontiers in Statistical Physics and Soft Matter, Edwards Symposium, Univ of Cambridge

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 presentations in conferences

2026 **DPG Spring Meeting**, **Active Matter V**, 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, **Stochastic Thermodynamics**, 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
Journées de Physique Statistique, Paris

Invited seminars and colloquia

2026 **Center for Data Science and Complexity Colloquium**, Univ of Münster
Institut für Theoretische Physik Seminar, Univ of Münster
Gulliver Lab Seminar, ESPCI, Paris
MPI Physics of Complex Systems Seminar, Dresden
Physics Dept Seminar, Technion
Institute of Advanced Studies Colloquium, Tel Aviv University

2025 **Soft Condensed Matter Seminar**, Harvard University
Biophysics Seminar, Massachusetts Institute of Technology
Solitons at Work Seminar (online)

2024 **Dept of Chemistry Seminar**, Univ of California, Berkeley
LPTMC Seminar, Sorbonne Univ, Paris
Dept of Physics Seminar, Univ of Liège
Institute of Physics Seminar, Univ of Leiden
Niels Bohr Institute Seminar, 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 Seminar** (online)
Soft Matter Seminar, DAMTP, Univ of Cambridge (online)
Mathematical Physics Seminar, Imperial College London (online)

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

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

2019 **Quantitative Life Sciences Seminar**, ICTP, Trieste
Dept of Chemistry Seminar, James Franck Institute, Univ of Chicago
Physics of Living Systems Seminar, Massachusetts Institute of Technology
DPhyMS Seminar, Univ of Luxembourg
Institute of Physics Seminar, Univ of Amsterdam

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

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

2016 **School of Mathematical Sciences Seminar**, Queen Mary Univ of London
Soft Matter Seminar, DAMTP, Univ of Cambridge
MSC Lab Seminar, Univ Paris Diderot
YITP Seminar, Kyoto

2015 **LiPhy Seminar**, Univ Grenoble Alpes
Physics-Biology Interface Seminar, Univ Paris Sud
Soft Matter Seminar, DAMTP, Univ of Cambridge
YITP Seminar, Kyoto

2014 **MSC Lab Seminar**, Univ Paris Diderot

Recording of some selected presentations are available at efodorphysics.github.io/talks.html

Scientific manuscripts

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)

* Equal contribution of these authors to this work