

Étienne Fodor

Postdoctoral Research Associate

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French | Born on January, 6 1990

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Education

- 2013 – 2016 **PhD in Theoretical Physics**, Université Paris Diderot | Summa cum laude.
Tracking nonequilibrium in living matter and self-propelled systems
Main topics | Nonequilibrium statistical mechanics, Biophysics, Active matter
Supervisors | Paolo Visco, Frédéric van Wijland
- 2012 – 2013 **Master in Physics – 2nd year**, École Normale Supérieure de Paris.
ICFP - Macroscopic Physics and Complexity
- 2011 – 2012 **Agrégation de Physique**, École Normale Supérieure de Cachan.
National competitive exam for teachers in classes préparatoires and in first years of French Universities
- 2010 – 2011 **Master in Physics – 1st year**, École Normale Supérieure de Lyon.
- 2009 – 2010 **Bachelor in Physics**, École Normale Supérieure de Lyon.

Research

Selected papers

How far from equilibrium is active matter?

É. Fodor, C. Nardini, M. E. Cates, J. Tailleur, P. Visco, and F. van Wijland
Phys. Rev. Lett. **117**, 038103 (2016) | Editor's suggestion | Physics (2016)

Entropy production in field theories without time-reversal symmetry: Quantifying the non-equilibrium character of active matter

C. Nardini, É. Fodor, E. Tjhung, F. van Wijland, J. Tailleur, and M. E. Cates
Phys. Rev. X **7**, 021007 (2017)

Activity-driven fluctuations in living cells

É. Fodor,* M. Guo,* N. S. Gov, P. Visco, D. A. Weitz, and F. van Wijland
EPL (Europhys. Lett.) **110**, 48005 (2015) | Editor's choice | Europhysics News 46/5 (2015)

How dissipation constrains fluctuations in nonequilibrium liquids: Diffusion, structure and biased interactions

L. Tociu, É. Fodor, T. Nemoto, and S. Vaikuntanathan
Phys. Rev. X **9**, 041026 (2019)

Optimizing active work: Dynamical phase transitions, collective motion and jamming

T. Nemoto, É. Fodor, M. E. Cates, R. L. Jack, and J. Tailleur
Phys. Rev. E **99**, 022605 (2019)

* Equal contribution of these authors to this work

Complete list of publications

- Preprints **Collective motion in large deviations of active particles**
Y.-E. Keta, É. Fodor, M. E. Cates, F. van Wijland, and R. L. Jack
arxiv:2009.07112
- Statistical mechanics of active Ornstein Uhlenbeck particles**
D. Martin, J. O'Byrne, M. E. Cates, É. Fodor, C. Nardini, J. Tailleur, and F. van Wijland
arxiv:2008.12972
- Thermodynamics of active field theories: Energetic cost of coupling to reservoirs**
T. Markovich, É. Fodor, E. Tjhung, and M. E. Cates
arxiv:2008.06735
- Time-reversal symmetry violations and entropy production in field theories of polar active matter**
Ø. L. Borthne, É. Fodor, and M. E. Cates
arxiv:2008.02332
- 2020 **Thermodynamic cycles with active matter**
T. Ekeh, M. E. Cates, and É. Fodor
Phys. Rev. E **102**, 010101(R) (2020)
- Dissipation controls transport and phase transitions in active fluids: Mobility, diffusion and biased ensembles**
É. Fodor, T. Nemoto, and S. Vaikuntanathan
New J. Phys. **22**, 013052 (2020)
- 2019 **Autonomous engines driven by active matter: Energetics and design principles**
P. Pietzonka, É. Fodor, C. Lohrmann, M. E. Cates, and U. Seifert
Phys. Rev. X **9**, 041032 (2019)
- How dissipation constrains fluctuations in nonequilibrium liquids: Diffusion, structure and biased interactions**
L. Tociu, É. Fodor, T. Nemoto, and S. Vaikuntanathan
Phys Rev. X **9**, 041026 (2019)
- Driven probe under harmonic confinement in a colloidal bath**
V. Démery and É. Fodor
J. Stat. Mech. **2019**, 033202 (2019)
- Optimizing active work: Dynamical phase transitions, collective motion and jamming**
T. Nemoto, É. Fodor, M. E. Cates, R. L. Jack, and J. Tailleur
Phys. Rev. E **99**, 022605 (2019)
- 2018 **Non-Gaussian noise without memory in active matter**
É. Fodor, H. Hayakawa, J. Tailleur, and F. van Wijland
Phys. Rev. E **98**, 062610 (2018)
- The statistical physics of active matter: From self-catalytic colloids to living cells**
É. Fodor and M. Cristina Marchetti
Physica A **504**, 106 (2018)
- Extracting maximum power from active colloidal heat engines**
D. Martin, C. Nardini, M. E. Cates, and É. Fodor
EPL (Europhys. Lett.) **121**, 60005 (2018) | Editor's choice | Highlights of 2018

Active mechanics reveal molecular-scale force kinetics in living oocytes

W. W. Ahmed,* É. Fodor,* M. Almonacid,* M. Bussonnier, N. S. Gov, M.-H. Verlhac, P. Visco, F. van Wijland, and T. Betz
Biophys. J. **114**, 1667 (2018)

Spatial fluctuations at vertices of epithelial layers: Quantification of regulation by Rho pathway

É. Fodor,* V. Mehandia,* J. Comelles, R. Thiagarajan, N. S. Gov, P. Visco, F. van Wijland, and D. Riveline
Biophys. J. **114**, 939 (2018)

2017 Entropy production in field theories without time-reversal symmetry: Quantifying the non-equilibrium character of active matter

C. Nardini, É. Fodor, E. Tjhung, F. van Wijland, J. Tailleur, and M. E. Cates
Phys. Rev. X **7**, 021007 (2017)

2016 Nonequilibrium dissipation in living oocytes

É. Fodor,* W. W. Ahmed,* M. Almonacid,* M. Bussonnier, N. S. Gov, M.-H. Verlhac, T. Betz, P. Visco, and F. van Wijland
EPL (Europhys. Lett.) **116**, 30008 (2016)

How far from equilibrium is active matter?

É. Fodor, C. Nardini, M. E. Cates, J. Tailleur, P. Visco, and F. van Wijland
Phys. Rev. Lett. **117**, 038103 (2016) | Editor's suggestion | Physics (2016)

Active cage model of glassy dynamics

É. Fodor, H. Hayakawa, P. Visco, and F. van Wijland
Phys. Rev. E **94**, 012610 (2016)

2015 Modeling the dynamics of a tracer particle in an elastic active gel

E. Ben Isaac, É. Fodor, P. Visco, F. van Wijland, and N. S. Gov
Phys. Rev. E **92**, 012716 (2015)

Active cell mechanics: Measurement and theory

W. W. Ahmed, É. Fodor, and T. Betz
Biochimica et Biophysica Acta - Mol. Cell Res. **1853**, 3083 (2015)

Activity-driven fluctuations in living cells

É. Fodor,* M. Guo,* N. S. Gov, P. Visco, D. A. Weitz, and F. van Wijland
EPL (Europhys. Lett.) **110**, 48005 (2015) | Editor's choice | Europhysics News 46/5 (2015)

Generalized Langevin equation with hydrodynamic backflow: Equilibrium properties

É. Fodor, D. S. Grebenkov, P. Visco, and F. van Wijland
Physica A **422**, 107 (2015)

2014 Energetics of active fluctuations in living cells

É. Fodor, K. Kanazawa, H. Hayakawa, P. Visco, and F. van Wijland
Phys. Rev. E **90**, 042724 (2014)

Conferences, seminars and summer schools

2020 Motile Active Matter Conference, Bonn | Contributed talk.

Symmetry, Thermodynamics and Topology in Active Matter, KITP online | Invited talk.

Department of Physics, University of Bath | Seminar.

2019 ICTP – Quantitative Life Sciences Group, Trieste | Seminar.

- James Franck Institute – Department of Chemistry**, University of Chicago | Seminar.
- Gordon Research Seminars – Soft Matter**, Colby-Sawyer College, New London | Poster.
- Physics of Living Systems**, Massachusetts Institute of Technology | Seminar.
- StatPhys – Out-of-equilibrium aspects**, Buenos Aires | Contributed talk.
- Physics and Materials Science Research Unit**, University of Luxembourg | Seminar.
- International Soft Matter Conference**, Edinburgh | Contributed talk.
- Statistical Physics of Complex Systems Conference**, Nordita, Stockholm | Contributed talk.
- Institute of Physics – Computational Soft Matter**, University of Amsterdam | Seminar.
- Colloids as a Toolbox for Statistical Mechanics**, University of Cambridge | Co-organizer.
- 2018 **LiPhy Laboratory**, Université Grenoble Alpes | Seminar.
- Charles Coulomb Laboratory**, Université de Montpellier | Seminar.
- ESPCI – Gulliver Laboratory**, Paris | Seminar.
- Why Measure Entropy Production?**, Princeton University | Invited talk.
- Nonequilibrium Collective Dynamics**, Technische Universität Berlin | Contributed talk.
- Stochastic Thermodynamics: Experiment and Theory**, MPI, Dresden | Poster.
- World Congress of Biomechanics – Non-equilibrium Biomechanics**, Dublin | Co-chair.
- St Catharine’s College – Graduate Research Seminars**, Cambridge | Seminar.
- Fundamental Problems in Active Matter**, Aspen Center for Physics | Contributed talk.
- Research Colloquium Series**, California State University, Fullerton | Seminar.
- Statistical Mechanics Meeting**, University of California, Berkeley | Poster.
- Active Matter Session**, University of California, Berkeley | Invited talk.
- 2017 **DAMTP – Soft Matter Seminar**, University of Cambridge | Seminar.
- Stochastic Thermodynamics, Active and Driven Systems**, ICTS, Bangalore | Poster.
- Fundamental Problems in Statistical Physics summer school**, Bruneck.
- SIAM-IMA Annual Conference**, University of Cambridge | Contributed talk.
- Edwards Centre Mini Conference**, University of Cambridge | Contributed talk.
- Open Statistical Physics**, Milton Keynes | Contributed talk.
- DAMTP – BioLunch Seminar**, University of Cambridge | Seminar.
- Edwards Centre Mini Conference**, University of Cambridge | Poster.
- 2016 **School of Mathematical Sciences**, Queen Mary University of London | Seminar.
- DAMTP – Soft Matter Seminar**, University of Cambridge | Seminar.
- StatPhys – Biological Physics**, Lyon | Contributed talk.
- MSC Laboratory Seminar**, Université Paris Diderot | Seminar.
- Advanced Statistical Mechanics Seminar**, YITP, Kyoto | Seminar.
- Non-Gaussian Workshop**, YITP, Kyoto | Contributed talk.
- 2015 **LiPhy Laboratory**, Université Grenoble Alpes | Seminar.
- Physics-Biology Interface Seminar**, Université Paris Sud | Seminar.
- DAMTP – Soft Matter Seminar**, University of Cambridge | Seminar.
- Lorentz Center – Active Liquids**, Leiden University | Contributed talk.
- Advanced Statistical Mechanics Seminar**, YITP, Kyoto | Seminar.
- Kyoto Winter School for Statistical Mechanics**, YITP, Kyoto.
- Luxembourg out of Equilibrium**, University of Luxembourg | Poster.
- 2014 **MSC Laboratory – Physique du vivant**, Université Paris Diderot | Seminar.
- Beg Rohu summer school**, Saint-Pierre Quiberon.

Condensed Matter in Paris, Université Paris Descartes | Contributed talk.

Physics and Biological Systems, Université Paris Sud | Poster.

MSC Laboratory – Theory Group, Université Paris Diderot | Seminar.

ESPCI – Journées de Physique Statistique, Paris | Contributed talk.

Mini Stat Mech Meeting, University of California, Berkeley | Poster.

Research associate visits

2019 **James Franck Institute**, University of Chicago | 2 weeks.

Host researcher | Suriyanarayanan Vaikuntanathan

2015 – 2016 **Yukawa Institute for Theoretical Physics**, Kyoto University | 2 months/year.

Host researcher | Hisao Hayakawa

Internships

2013 **Master – 2nd year**, Université Paris Diderot | 16 weeks.

Modeling active forces in living cells

Supervisors | Paolo Visco, Frédéric van Wijland

2011 **Master – 1st year**, University of Oxford | 12 weeks.

Complete characterization and control of extreme ultraviolet pulses from high harmonic generation

Supervisors | Adam S. Wyatt, Ian A. Walmsley

2010 **Bachelor**, Université de Genève | 8 weeks.

CARS microspectroscopy using a single laser source

Supervisors | Jérôme Extermann, Luigi Bonacina, Jean-Pierre Wolf

Teaching and supervision

Since 2017 **PhD co-supervision**, DAMTP – University of Cambridge.

Students | Oyvind Borthne, Timothy Ekeh

2019 – 2020 **Part III project**, DAMTP – University of Cambridge | 8 months.

Optimizing phase transitions in active matter

Part III student | Jacob W. Knight (University of Cambridge)

2017 – 2018 **Part III project**, DAMTP – University of Cambridge | 8 months.

Designing a macroscopic active heat engine

Part III student | Timothy Ekeh (University of Cambridge)

2016 – 2017 **Internship supervision**, DAMTP – University of Cambridge | 5 months.

Tracer dynamics in an active medium

Master student | David Martin (École Normale Supérieure de Paris)

2013 – 2016 **Physics tutorials**, Université Paris Diderot | 64 hours/year.

First-year University training in medical Physics

2012 – 2013 **Physics tutorials**, Lycée Fénélon, Paris | 23 hours.

Classes préparatoires

2010 – 2011 **Physics tutorials**, Lycée la Martinière Monplaisir, Lyon | 60 hours.

Classes préparatoires

Computing experience

Linux systems, Mathematica, \LaTeX , Programming in C and PYTHON

Review service

EPL - J. Stat. Mech. - Nat. Phys. - New J. Phys. - Phys. Rev. E - Phys. Rev. Lett. - Phys. Rev. X

Scholarships, fellowships and prizes

2017 – 2020 **Junior Research Fellowship**, St Catharine's College, Cambridge.

2017 – 2020 **Oppenheimer Research Fellowship**, University of Cambridge.
2017 **3rd PhD prize** | **Institut des Systèmes Complexes**, Paris.
2017 **Best talk prize** | **SIAM-IMA Annual Conference**, University of Cambridge.
2015 **Best talk prize** | **Lorentz Center – Active Liquids**, Leiden University.
2013 – 2016 **Teaching Assistantship**, Université Paris Diderot.
2013 – 2016 **PhD Scholarship**, École Normale Supérieure de Cachan.
2011 – 2013 **Master Scholarship**, École Normale Supérieure de Cachan.

Academic references

Prof. Michael E. Cates

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Dr. Julien Tailleur

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UMR 7057 CNRS/P7, Université Paris Diderot
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75205 Paris Cédex 13, France
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Prof. Frédéric van Wijland

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Dr. Suriyanarayanan Vaikuntanathan

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