

PERSONAL INFORMATION

Sara Dal Cengio

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WORK EXPERIENCE

September 2024 – Present

Marie Skłodowska-Curie Individual Fellow

Department of Physics, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

Supervisor: Prof. Julien Tailleur

Research topics: Active matter, population dynamics

February 2021 – April 2024

Postdoctoral Researcher

Laboratoire Interdisciplinaire de Physique (LIPhy), Université Grenoble Alpes, France

Supervisor: Dr. Vivien Lecomte

Research topics: chemical reaction networks, metabolic network reconstruction, Active matter, large deviation theory

EDUCATION AND TRAINING

January 2017 – December 2020

Ph.D. in Physics with Honors

Universitat de Barcelona, Spain

Supervisor: Prof. Ignacio Pagonabarraga

Thesis: *“Competition and response: from active matter to electrolyte under confinement”***Scientific visit:** École Normale Supérieure de Paris, France (09/2018 – 06/2019), with Prof. Lyderic Bocquet

December 2014 – October 2016

M.Sc. in Physics of Complex Systems (110/110 with Honors)

Università degli Studi di Torino, Italy

Thesis: *“Fluctuations in nonequilibrium systems and time symmetry breaking”*

Supervisor: Prof. Lamberto Rondoni

September 2011 – September 2014

B.Sc. in Chemistry (110/110 with Honors)

Università degli Studi di Padova, Italy

Thesis: *“Features in stochastic chemical kinetics: similarity with the “slow manifolds” phenomenology for macroscopic reactive systems”*

Supervisor: Dr. Diego Frezzato

PUBLICATIONS

- [1] Matteo Polettini, Pedro E Harunari, Sara Dal Cengio, and Vivien Lecomte. “Coplanarity of rooted spanning-tree vectors: M. Polettini et al.” In: *Letters in Mathematical Physics* 116.1 (2025), p. 1.
- [2] Sara Dal Cengio, Pedro E. Harunari, Vivien Lecomte, and Matteo Polettini. “Mutual multilinearity of nonequilibrium network currents”. In: *SciPost Phys.* 19 (2025), p. 111. URL: <https://scipost.org/10.21468/SciPostPhys.19.4.111>.

- [3] Sara Dal Cengio, Romain Mari, and Eric Bertin. "Giant density fluctuations in locally hyperuniform states". In: *Phys. Rev. E* 112 (4 Oct. 2025), p. L042101. URL: <https://link.aps.org/doi/10.1103/m6bl-dqsd>.
- [4] Pedro E. Harunari, Sara Dal Cengio, Vivien Lecomte, and Matteo Polettini. "Mutual Linearity of Nonequilibrium Network Currents". In: *Phys. Rev. Lett.* 133 (4 July 2024), p. 047401. URL: <https://link.aps.org/doi/10.1103/PhysRevLett.133.047401>.
- [5] Francesco Avanzini, Massimo Bilancioni, Vasco Cavina, Sara Dal Cengio, Massimiliano Esposito, Gianmaria Falasco, Danilo Forastiere, Nahuel Freitas, Alberto Garilli, Pedro E. Harunari, Vivien Lecomte, Alexandre Lazarescu, Shesha G. Marehalli Srinivas, Charles Moslonka, Izaak Neri, Emanuele Penocchio, William D. Piñeros, Matteo Polettini, Adarsh Raghu, Paul Raux, Ken Sekimoto, and Ariane Soret. "Methods and conversations in (post)modern thermodynamics". In: *SciPost Phys. Lect. Notes* (2024), p. 80. URL: <https://scipost.org/10.21468/SciPostPhysLectNotes.80>.
- [6] Sara Dal Cengio, Vivien Lecomte, and Matteo Polettini. "Geometry of Nonequilibrium Reaction Networks". In: *Phys. Rev. X* 13 (2 June 2023), p. 021040. URL: <https://link.aps.org/doi/10.1103/PhysRevX.13.021040>.
- [7] Sara Dal Cengio, Demian Levis, and Ignacio Pagonabarraga. "Fluctuation–dissipation relations in the absence of detailed balance: formalism and applications to active matter". In: *Journal of Statistical Mechanics: Theory and Experiment* 2021.4 (Apr. 2021), p. 043201. URL: <https://dx.doi.org/10.1088/1742-5468/abee22>.
- [8] Sara Dal Cengio, Demian Levis, and Ignacio Pagonabarraga. "Linear Response Theory and Green-Kubo Relations for Active Matter". In: *Phys. Rev. Lett.* 123 (23 Dec. 2019), p. 238003. URL: <https://link.aps.org/doi/10.1103/PhysRevLett.123.238003>.
- [9] Sara Dal Cengio and Ignacio Pagonabarraga. "Confinement-controlled rectification in a geometric nanofluidic diode". In: *The Journal of Chemical Physics* 151.4 (July 2019), p. 044707. eprint: https://pubs.aip.org/aip/jcp/article-pdf/doi/10.1063/1.5108723/15565411/044707_1__online.pdf. URL: <https://doi.org/10.1063/1.5108723>.
- [10] Sara Dal Cengio and Lamberto Rondoni. "Broken versus Non-Broken Time Reversal Symmetry: Irreversibility and Response". In: *Symmetry* 8.8 (2016). URL: <https://www.mdpi.com/2073-8994/8/8/73>.
- [11] Sara Dal Cengio, Quentin Laurenceau, Vivien Lecomte, Charline Smadi, and Julien Tailleur. "When evolution realizes large deviations of fitness: from speciation to dynamical phase transitions". In: *arXiv preprint arXiv:2601.04325* (2026).

ORAL AND POSTER PRESENTATIONS IN CONFERENCES

- APS Global Physics Summit, Denver, USA, March 2026 (Oral)
- DONEV Cecam workshop: Dynamics of Non-Equilibrium Variables: Multiscale-multiphysics applications of fluctuating hydrodynamics, Zaragoza, Spain, September 2025 (Oral)
- StatPhys29, International Conference on Statistical Physics, Florence, Italy, July 2025 (Oral)
- StatPhys29, International Conference on Statistical Physics, Florence, Italy, July 2025 (Oral)
- From flocking birds to migrating cells, Statphys29 satellite meeting, Leiden, The Netherlands, July 2025 (Oral)
- Fall 2024 Meeting of the APS New England Section, Northeastern University, Boston, USA, September 2024 (Oral)
- Minisymposium on Chemical Reaction Networks, Politecnico di Torino, Italy, June 2023 (Oral)
- Workshop on Signatures of Nonequilibrium Fluctuations in Life, ICTP, Trieste, Italy, May 2023 (Poster)
- Journées de Physique Statistique, Paris, France, January 2022 (Oral)
- 2nd Biology for Physics conference, Barcelona, Spain, July 2022 (Poster)
- WOST III Workshop on Stochastic Thermodynamics, Tokyo, Japan, May 2022 (Oral, online)
- StatPhys27, International Conference on Statistical Physics, Buenos Aires, Argentina, July 2019 (Poster)
- Physics of Active Matter: Statphys 2019 Satellite Meeting, Viña del Mar, Chile, July 2019 (Oral)
- Statistical mechanics of active matter workshop, Gran Sasso Science Institute, L'Aquila, Italy, June 2019 (Poster)
- European Training Network Nanotrans annual meeting, Cumberland Lodge, Windsor, UK, March 2019 (Oral)
- Conference NECD18: Bridging the Gap between Hard and Soft Materials, Potsdam, Germany, October 2018 (Oral)
- Conference LAI18 Liquids @ Interfaces, Bordeaux, France, October 2018 (Oral)
- Entropy 2018: From Physics to Information Sciences and Geometry, Barcelona, Spain, May 2018 (Poster)
- Nordita Workshop, Current and Future Trends in Stochastic Thermodynamics, Stockholm, Sweden, September 2017 (Oral)

INVITED SEMINARS AND LECTURES

- Lecturer on "The Doi-Peliti formalism in a nutshell", DONEV Cecam workshop, Zaragoza, Spain, September 2025
- Seminar at the DAMTP Statistical Physics and Soft Matter webinar, Cambridge University, UK, February 2025
- Seminar at the Physics Department of Harvard University, Cambridge, USA, December 2024
- Seminar at the Edinburgh Statistical Physics and Complexity webinar series, UK, December 2024
- Seminar at the "Physics of Living Systems short talks", MIT, Cambridge, USA, November 2024
- Seminar at the Division of Theoretical Ecology and Evolution, University of Bern, Switzerland, April 2024
- Seminar at the Department of Physics of La Sapienza Università di Roma, Italy, June 2024
- Seminar at the Department of Physics, Università degli Studi di Padova, Italy, February 2024
- Seminar at the Department of Physics, University of Cologne, Germany, June 2023
- Lecturer on "Network theory and nonequilibrium thermodynamics", (Post)modern Thermodynamics winter school+workshop, Luxembourg, December 2022
- Seminar at the Faculty of Physics and Earth Science, University of Leipzig, Germany, November 2022
- Seminar at the Matter and Complex Systems Lab, Université Paris Diderot, France, October 2022
- Lecturer on "On the geometry of forces and currents in complex reaction networks", Physics of Life Summer School, Edinburgh, UK, April 2022
- Seminar at the Laboratoire Interdisciplinaire de Physique (LIPhy), Université Grenoble Alpes, France, January 2021
- Seminar at the Physics Department of La Sapienza Università di Roma, Italy, February 2021

SCHOOLS ATTENDED

- (Post)modern Thermodynamics winter school+workshop, Luxembourg, December 2022
- Physics of Life Summer School, Edinburgh, UK, April 2022
- The Beg Rohu Summer School: Statistical Mechanics and Emergent Phenomena in Biology, France, June 2021
- Molsim: Understanding Molecular Simulations, Cecam winter school, Amsterdam, Netherlands, January 2018
- Transport of Soft Matter at the Nanoscale, Cecam summer school, Mainz, Germany, June 2017

TEACHING EXPERIENCE

- Teaching Assistant for *Statistical Mechanics I* (8.333), MIT, Fall 2024 (20 h)
- Lecturer: Large deviations theory in physics, ENS Lyon, Feb 2023 (4h)

CO-ORGANIZATION OF SCIENTIFIC EVENTS

- December 2023: Co-organizer of the second edition of the workshop “*Population dynamics: from rare events to evolution*”, Grenoble, France. Funded by MITI (CNRS) Mission pour les initiatives transverses et interdisciplinaires.
- December 2022: Co-organizer of the first edition of the workshop “*Population dynamics: from rare events to evolution*”, Grenoble, France. Funded by MITI (CNRS) Mission pour les initiatives transverses et interdisciplinaires.
- September 2019: Co-organizer of the panel on science communication “*Narrative hybridization: how to rethink science communication*” at the annual congress of ADI (Associazione Degli Italianisti), Pisa, Italy.
- August 2018: Co-organizer of the NANOTRANS Early Stage Researcher Workshop, Vienna, Austria. Funded by the European Union’s Horizon 2020 research and innovation program.

REFEREEING ACTIVITY

Reviewer for:

- Journal of Chemical Physics (AIP Publishing)
- Soft Matter (Royal Society of Chemistry)
- Physical Review E (American Physical Society)
- Europhysics Letters (IOP Science)
- Physical Review X (American Physical Society)

SCIENCE COMMUNICATION ACTIVITIES

- Member of eXtemporanea (2018 – 2023): organized science events, public lectures, and podcast series
- Workshop facilitator for European Training Network Phy-Mot, October 2023

FELLOWSHIPS AND AWARDS

- Marie Skłodowska-Curie Postdoctoral Fellowship (2024 – 2027)
- Human Frontier Science Program Postdoctoral Fellowship (2023)
- Best Thesis Award, Università degli Studi di Torino (2018)

PERSONAL SKILLS**Languages**

- Italian (native)
- English (advanced)
- Spanish (good)
- French (good)

Computer Skills

- Programming languages: C, C++, Python, Mathematica, MATLAB
- Software: COMSOL, gnuplot, LaTeX