

Amélie Chardac | Postdoctoral researcher in Physics

☎ +1 (339)215-9726 • ameliechardac@brandeis.edu
perso.ens-lyon.fr/amelie.chardac/ • ORCID iD: 0000-0002-8783-7107

I am a soft condensed matter physicist interested in pattern formation and collective behavior. I perform experiments and analyze data in order to investigate how topological defects and external fields affect self-organization in active systems. Currently a Postdoctoral Associate in the DuclosLab (Brandeis University, US), I work on investigating morphogenesis via chemomechanical couplings. My PhD work in the BartoloLab (ENS de Lyon, France) consisted in understanding the marvelous phases of polar active matter and their robustness to disorder. I have acquired expertise in microfabrication, extensive image and data analysis, optical microscopy, protein purification and experimental design. I am also interested in Education and Outreach. I am currently a Fellow in the "Science Communication Center" (*SciCommLab*) at Brandeis University, where I help scientists improve their Science Communications skills.

Research experience

- Postdoctoral associate at Brandeis University, Waltham MA, US** Mar. 2022 – ...
Projects : "Chemomechanical couplings to investigate morphogenesis and pattern formation"
& "Polymerization-based active matter", in the group of Dr. Guillaume Duclos.
Active matter, biophysics, data analysis, protein purification, microscopy, project management.
- Postdoctoral researcher at Laboratoire de Physique, ENS de Lyon, France** Dec. 2021 – Feb. 2022
Project : "Hydraulics of polar active matter", in the group of Prof. Denis Bartolo.
Active matter, topological defects, active microfluidics.
- PhD in Physics - ENS de Lyon, France** 2018 – 2021
Supervised by Prof. Denis Bartolo : "Polar active matter : order, disorder and topological defects."
Active matter, topological defects, microfluidics, photolithography, extensive data analysis.
- Research Internship - Ecole Normale Supérieure de Lyon, France** Mar.– Jul. 2018
Supervised by Prof. Denis Bartolo : "Active matter and collective motion in random media"
Photolithography, microfluidics, microscopy, statistical data analysis, PIV, particle tracking.
- Research Internship - Cavendish Laboratory, Univ. of Cambridge, UK** Apr.– Jul. 2016
Supervised by Prof. Pietro Cicuta : "Single cell measurement and analysis of noise in gene expression and growth in bacteria *E. coli*"
Cell culture, fluorescent microscopy, image analysis, statistical data analysis, science communication.
- Preparation for the International Physicists' Tournament (IPT)** 2016
Active member of the preparation team at the ENS de Lyon
Modelisation, building experimental setups, particle tracking.
- Research Internship - LiPhy Laboratory, Grenoble, France** Jun.– Jul. 2015
Supervised by Dr. Salima Rafai : "Study of phototaxis for the microalgae *Chlamydomonas Reinhardtii*"
Microfluidics, microscopy, image analysis, statistical data analysis.

Education and diploma

- PhD in Physics** 01/12/2021
Ecole Normale Supérieure de Lyon, France
Polar active liquids : order, disorder and topological defects
- MS in Soft Matter and Biological Physics - ICFP** 2018
Ecole Normale Supérieure Paris, France
Specialized in hydrodynamics, non-linear physics, statistical physics, soft matter, biophysics and liquid interfaces
Awarded with honors

Graduated from the Ecole Normale Supérieure de Lyon, France <i>a French "Grande Ecole"</i> (leading institution of higher education, the entrance of which is based on a competitive examination)	2017
Agrégation de Physique-Chimie, option Physique <i>National competitive exam of teaching in Physics, Admitted : rank 76th /1515</i> MD in Science of Education	2017
BS-MS in Physics <i>Ecole Normale Supérieure de Lyon, France</i> Awarded with honors	2015-2016
"Classes Préparatoires" in Physics and Mathematics, Lycée Malherbe - Caen, France <i>Equivalent : Bachelor of Science in Physics and Mathematics (1st year and 2nd year)</i>	2011 – 2014

Teaching, Mentoring and Outreach

Fellow in the Brandeis Science Communications Lab <i>The SciComm Lab is a science-communication resource center.</i> Conducted 50+ hr of one-on-one coaching appointments with undergraduate and graduate students, organized and conducted 8 workshops (abstract writing, NFS-Fellowship writing, keeping a lab notebook, writing a personal statement, poster design), developed communication, managerial and mentoring skills.	Jun. 2022 – Current
Mentorship - Brandeis University, US <i>Supervision of three undergraduates students and one graduate student</i> Organize training sessions, provide feedback, discuss techniques and results, lead weekly one-on-one meetings.	Apr. 2022– Current
Scientific Communication Online Program (SCOPE) - Northwestern University <i>Successfully completed the 10 weeks program, achieving a certificate in Science Communication</i> Followed classes and gave peer review, Brainstormed content, designed and prepared materials to create a 3 min movie about my research.	Fall 2023
2nd place at the Brandeis MRSEC Video Competition <i>Created a 2 min outreach video about my research.</i>	Sept. 2022
Participation in a Science Museum exhibition <i>Exhibition "Crowds" at Cite des Sciences et de l'Industrie, Paris, France</i> Brainstormed content, designed and prepared materials to create an outreach movie about my research.	2021 - 2022
Co-advisor of Camille Jorge (MS student) - ENS de Lyon, France <i>Experimental four-months internship about "frustration in polar active matter".</i> Performed training for experiments, discussed data analysis and interpretation, reviewed Master thesis.	Apr. – Jul. 2021
Teaching Assistant for the Physics Department at the ENS de Lyon <i>Teaching Assistant for lab work for Bachelor students in Physics.</i> <i>Instructor for the preparation of the national competitive exam "agrégation de Physique".</i> <i>Tutor and member of committee for Bachelor and Master thesis (10+).</i> Optics, mechanics, hydrodynamics, acoustics, soft matter. 64h per year	2018 – 2021
Co-advisor of Yoann Poupart (BS student) - ENS de Lyon, France <i>Numerical two-months internship about simulation of polar active flows.</i> Discussed technics and results, analyzed data, proofread Bachelor thesis.	June – July 2020
Collaboration with Alex Andrix to create an artistic VR experience about collective effects <i>"Variations Physiques vol. 2" , http://variationsphysiques.fr/vr/</i>	2019
Visiting days at ENS de Lyon for High-school and undergraduates students. <i>Prepared and presented a poster about active matter for outreach days. Welcomed students.</i> Science fairs (2 days). Students visiting the lab to discover the job of researcher (15 hrs).	2018 – 2019
Volunteer of the association "ENSeigner" at ENS de Lyon for High school students <i>Private teacher in Physics and Mathematics</i> Prepared courses and exercises - Explained lessons	2014 – 2017

Publications

Active hydraulics laws from frustration principles

6.

[Chardac* A., Jorge* C., Poncet* A., Bartolo D., *Nat. Phys.* \(2024\). \[Preprint\]](#)

Les liquides actifs : du chaos à l'ordre 5.

[Chardac A., Bartolo D. *La Recherche N570*, pp. 92-97 \(2022\).](#)

Polar active matter : order, disorder and topological defects 4.

[Chardac A. *Ph.D. Thesis* \(2021\).](#)

Topology-driven ordering of flocking matter 3.

[Chardac A., Hoffmann L., Poupart Y., Giomi L., Bartolo D. *Phys. Rev. X* 11, 031069 \(2021\).
\[PRX Highlights\] \[Preprint\]](#)

Emergence of dynamic vortex glasses in disordered polar active fluids 2.

[Chardac A., Shankar S., Marchetti M. C., Bartolo D. *Proc. Natl. Acad. Sci. USA*, 118\(10\) \(2021\).
\[Cover picture\] \[Preprint\]](#)

Oscillations in a half-empty bottle 1.

[Bourges A., Chardac A., Caussariou A., Plihon N., Taberlet N. *American Journal of Physics*. 86. 119-125. \(2018\)](#)

Conferences and Seminars

APS March Meeting Mar. 2024

Oral contribution : "Coupling reaction-diffusion and active matter to investigate morphogenesis"
Minneapolis, MN, USA

New England Complex Fluids Workshop Sept. 2023

Oral contribution : "Coupling reaction-diffusion and active matter to investigate morphogenesis"
Brandeis University, Waltham, MA, USA

Gordon Research Conference (GRC) - Soft condensed matter Aug. 2023

Poster contribution : "Investigating morphogenesis via chemomechanical couplings"
New London, NH, USA

Brandeis MRSEC 2023 Winter school Feb. 2023

Poster : "Investigating pattern formation and morphogenesis via chemo-mechanical couplings"
Crawford Notch (NH), USA

IRG2 workshop Jan. 2023

Invited talk : "Investigating pattern formation and morphogenesis via chemo-mechanical couplings"
Brandeis MRSEC

Rising Stars Soft and Biological Matter symposium Oct. 2022

Invited talk : "Topology-driven ordering of flocking matter"
Virtual, UChicago MRSEC

Summer School Active Matter and Complex Media Oct. 2022

Invited talk : "Topology-driven ordering of flocking matter"
Cargese, France

Squishy Physics Seminar Apr. 2022

Invited talk : "Life and death of topological defects in polar active matter."
Harvard, Cambridge (MA), USA

LOMA's Seminar Feb. 2022

Invited talk : "Life and death of topological defects in flocking matter."
Bordeaux, France

LiPhy's Seminar Nov. 2021

Invited talk : "Life and death of topological defects in flocking matter."
Grenoble, France

APS March Meeting Mar. 2021

Oral contribution : "Domain-wall networks rule the ordering dynamics of flocking matter"

MRSEC Brandeis Seminar Feb. 2021

Invited talk : "Life and death of topological defects in polar active liquids."
Waltham, MA, USA

Prof. C. Bechinger's group Seminar <i>Invited talk : "Life and death of topological defects in polar active liquids."</i> Konstanz, Germany	Feb. 2021
APS March Meeting <i>Oral contribution : "Meandering flows and dynamical vortex glasses in disordered polar active matter"</i> Denver, CO, USA	Mar. 2020
Gordon Research Conference (GRC) - Soft condensed matter <i>Poster contribution : "Flocking through disorder"</i> New London, NH, USA	Aug. 2019
PhD student's day <i>Oral contribution : "Flocking through disorder"</i> Laboratoire de Physique, ENS de Lyon, Lyon, France	Jun. 2019

Awards and fellowships

Seal of Excellence MSCA Postdoctoral Fellowships: Obtained for the proposal PACMAN submitted under the call Horizon Europe Maria Sklodowska-Curie Action HORIZON-MSCA-2022-PF-01. This distinction recognised a high-quality project proposal in a highly competitive evaluation process that could not receive funding due to budgetary constraints.

Awarded "Rising Stars in Soft and Biological Matter": by UChicago MRSEC, Oct. 2022

Ph.D Fellowship: Ecole Doctorale PHAST, Sept. 2018 - Dec. 2022. Total : 55 000€

Scholarship for a Master degree: ICFP, ENS Paris, Sept. 2017 - Aug. 2018. Total : 6000€

Technical and transferable skills

Experimental skills: UV lithography, microfluidics, micro-pipetting, optical microscopy, cell culture, protein purification

Analysis tools: Quantitative image analysis, PIV, PTV, extensive data analysis

Certifications: Ethics in Research, Health and Safety regulations in the lab, Science Communication

Programming languages: Matlab, Python, Bash, FeniCs

Scientific communication: Scientific writing, visual design, lab notebook, writing efficient emails, reviewing process for journals

Spoken languages: French (native speaker), English (C1 certified), German (intermediate, B1)

Soft skills: Project management, time management, mentorship, resilience, troubleshooting, science communication, public speaking, teamwork

Other: AutoCAD, ImageJ, Micromanager, Pack Office

Academic references

Dr. Guillaume Duclos: MRSEC Brandeis University. Waltham (MA), USA, gduclos@brandeis.edu, +1 (617) 401-1901, duclos-lab.com

Prof. Denis Bartolo: Laboratoire de Physique, Ecole Normale Supérieure de Lyon. Lyon (France), denis.bartolo@ens-lyon.fr, +33 (0)4 72 72 84 92, <https://bartololab.com>

Dr. Anahita Zare: Director of Education, Outreach, and Diversity at MRSEC Brandeis University. Waltham (MA), USA, azare@brandeis.edu