

Research Interests

Statistical Physics, Single-cell omics, Cellular Processes, Stochastic Modeling, Statistical Inference

Position

2022–present **Flatiron Research Fellow**, *Center for Computational Biology, Flatiron Institute, Simons Foundation*, New York, USA
Joint between Biophysical Modeling & Genomics groups.
Advisor: Prof. Michael J. Shelley.

Education

- 2018–2022 **Ph.D. in Physics**, *Laboratoire de Physique de l'École Normale Supérieure*
Advisors: Dr. Aleksandra Walczak and Dr. Thierry Mora.
Thesis: *Inference and modeling of biological networks: from active matter to the immune system.*
- 2017–2018 **M.Sc. in Physics**, *École Normale Supérieure*
International Center for Fundamental Physics, Quantum Physics major, Statistical Physics minor.
Research internship at Laboratoire de Physique de l'École Normale Supérieure.
Advisors: Dr. Aleksandra Walczak and Dr. Thierry Mora.
Thesis: *Inferring equations of motion of active flocks.*
- May–July 2017 **Visiting Scholar**, *Lawrence Berkeley National Laboratory*, Berkeley, USA
Advisor: Dr. Jean-Luc Vay – ESPCI Fonds Charpak Excellence Fellowship.
Project: *Assessment of recent advances in relativistic particle pusher algorithms.*
- 2014–2017 **M.Sc. in Physics**, *ESPCI Paris*
Research internship at French Alternative Energies and Atomic Energy Commission.
Advisors: Dr. Laurent Gremillet and Dr. Benoit Canaud.
Thesis: *Investigation of kinetics effects in Inertial Confinement Fusion.*
- 2012–2014 **Preparatory Classes**, *Lycée Joffre*, Montpellier
Successful at ESPCI Paris, Mines ParisTech, Ponts ParisTech, Centrale Lyon.

Publications

1. F Ferretti, **V Chardès**, T Mora, AM Walczak, I Giardina (2020) Building General Langevin Models from Discrete Datasets. *Physical Review X* 10, 031018, <https://journals.aps.org/prx/abstract/10.1103/PhysRevX.10.031018>.
2. F Ferretti, **V Chardès**, T Mora, AM Walczak, I Giardina (2022) Renormalization group approach to connect discrete- and continuous-time descriptions of Gaussian processes. *Physical Review E*, <https://journals.aps.org/pre/abstract/10.1103/PhysRevE.105.044133>.
3. **V Chardès**, M Vergassola, AM Walczak, T Mora (2022) Affinity maturation for an optimal balance between long-term immune coverage and short-term resource constraints. *Proceedings of the National Academy of Sciences* 119, e2113512119, <https://www.pnas.org/doi/abs/10.1073/pnas.2113512119>.
4. **V Chardès**^{*}, A Mazzolini^{*}, T Mora, AM Walczak (2023) Evolutionary stability of antigenically escaping viruses. *Proceedings of the National Academy of Sciences* 120, e2307712120, <https://www.pnas.org/doi/abs/10.1073/pnas.2307712120>.
5. **V Chardès**^{*}, S Maddu^{*}, MJ Shelley (2023) Stochastic force inference via density estimation. *NeurIPS 2023 AI for Science Workshop*, <https://arxiv.org/abs/2310.02366>.
6. S Maddu^{*}, **V Chardès**^{*}, MJ Shelley (2024) Learning stochastic processes with intrinsic noise from cross-sectional biological data. *Proceedings of the National Academy of Sciences*, 122, (37) e2420621122, <https://www.pnas.org/doi/10.1073/pnas.2420621122>.
7. S Zhang, S Maddu, X Qiu, **V Chardès** (2025) Inferring stochastic dynamics with growth from cross-sectional data. *Accepted at NeurIPS 2025*, <https://arxiv.org/abs/2505.13197>.

8. **V Chardès** (2025) Random Matrix Theory-guided sparse PCA for single-cell RNA-seq analysis. *arXiv preprint 2509.1542* (<https://www.arxiv.org/abs/2509.15429>).

Talks and Posters

- July 2025 **StatPhys 29 Conference**, *Florence, Italy*, Inferring biological processes with intrinsic noise from cross-sectional data (contributed talk)
- May 2025 **Max Planck Institute for Dynamics and Self-Organization**, *Goettingen, Germany*, Inferring biological processes with intrinsic noise from cross-sectional data (invited seminar)
- March 2025 **APS Global Physics Meeting**, *Anaheim*, Random Matrix Theory-guided denoising of single-cell RNA-seq data (contributed talk)
- Feb. 2025 **LIFEWARE Team INRIA Saclay**, *Paris, France*, Inferring biological processes with intrinsic noise from cross-sectional data (invited seminar)
- March. 2024 **APS March Meeting**, *Minneapolis*, Talk: Stochastic force inference via density estimation
- Oct. 2023 **NeurIPS 2023 AI for Science Workshop**, *New Orleans*, Poster: Stochastic force inference via density estimation
- March. 2023 **APS March Meeting**, *Las Vegas*, Talk: Eco-evolutionarily stable strategies of antigenically escaping viruses
- Sept. 2021 **On Future Synergies for Stochastic and Learning Algorithms**, *CIRM, Marseille, France*, Poster: Immune response as a decision process
- March 2021 **APS March Meeting**, *Online*, Talk: Optimal response to pathogen evolution in Immune Repertoires
- Aug. 2019 **qBio 2019 Conference**, *UCSF, San Francisco, USA*, Poster: Optimal response to pathogen evolution in immune repertoires
- July 2019 **Boulder School for Condensed Matter and Materials Physics**, *University of Colorado, Boulder, USA*
- April 2019 **Tumors and Immune Systems: From Theory to Therapy**, *Cargèse, France*, Poster: Optimal response to pathogen evolution in immune repertoires
- Nov. 2018 **3rd Course on Multiscale Integration in Biological Systems**, *Fall School, Institut Curie, Paris, France*, Poster: Inferring equations of motion of active flocks

Teaching Experience

- July 2025 **Computational Workshop**, *Biophysics Summer School*, University of Crete, Greece, 4 hours computational workshop on Turing patterns and inference from stochastic trajectories
- 2019–2020 **Analysis and Probabilities**, *Sorbonne Université*, Paris, France, Teaching Assistant: second year of Bachelor of Science, 26 hours/year
- 2018–2020 **Distributions and Fourier Analysis**, *Sorbonne Université*, Paris, France, Teaching Assistant: third year of Bachelor of Science, 28 hours/year
- 2018–2020 **Physics of Dynamical Systems**, *Sorbonne Université*, Paris, France, Teaching Assistant: second year of Bachelor of Science, 24 hours/year

Co-organized Workshops

- 2024 **Modeling and Inference of Stochastic Processes in Cells**, *Flatiron Institute, Simons Foundation*, two days workshop with support from the Simons Foundation
- 2019 & 2020 **Paris Biological Physics Community Day**, *Laboratoire the Physique de de l'École Normale Supérieure*, one day conference for young researchers in Biological Physics

Reviewer Work

Physical Review X, Physical Review E