Nicolás Pablo **Müller**

Postdoctoral Researcher - Fluid Dynamics and Turbulent Flows

nicolas.muller@lpp.polytechnique.fr | Google scholar

I am a theoretical physicist specializing in fluid dynamics, quantum fluids and turbulent flows, with a strong expertise in **Computational Fluid Dynamics**. Currently, I am a postdoctoral researcher at the Laboratoire de Physique des Plasmas (LPP) at the École Polytechnique in Paris, where my research focuses on the theoretical and numerical study of **wave turbulence in the solar wind**. My research interests also include **geodynamo, quantum fluids and superfluid turbulence**, exploring the fundamental connections with **classical turbulence**. My work integrates advanced numerical simulations and theoretical modeling to address complex problems in fluid dynamics.

Research Experience

Laboratoire de Physique des Plasmas — *Palaiseau, France*

Postdoctoral Researcher — *September 2025 - Present*

- Wave turbulence in the solar wind.

Laboratoire de Physique de l'ENS — *Paris, France*

Postdoctoral Researcher — *September 2023 - August 2025*

- Magnetic reversals in geodynamo with a stably-stratified layer.

Observatoire Côte d'Azur — *Nice, France*

Postdoctoral Researcher — *February 2023 - August 2023*

- Study of circulation statistics in two-dimensional classical and quantum turbulence.

Education

PhD in Physics — *Nice, France*

Observatoire de la Côte d'Azur - Supervisor: Giorgio Krstulovic — *2019 - 2022*

- Thesis Title: *Quantum vortices, statistics of velocity circulation and excitations in superfluid turbulence*

***Licenciatura* in Physical Science (equivalent to Bachelor and Master's degree in Physics)** — *Buenos Aires, Argentina*

University of Buenos Aires — *2014 - 2019*

- **(Equivalent to) M.Sc Thesis:** *Critical transition between 2D-3D flows in quantum turbulence — 2018-2019*
- **(Equivalent to) B.Sc Thesis:** *Design and construction of a robust illumination system for SPIM Microscopy — 2017*

Awards

Thesis Prize — *Nice, France*

UniCA Foundation - EDSFA — *3 June - 2024*

- Best thesis of 2022 of the Fundamental and Applied Science Doctoral School (EDSFA)

Grants

Allocation of computational hours in France National Cluster GENCI — *Paris, France*

GENCI — *Nov 2024 - Oct 2025*

- Project Title: *Magnetic reversals in a geodynamo model with a stably-stratified layer*
- Allocation of 3.300.000 computational hours.

Students

Co-supervision of Master Student — *Nice, France*

Observatoire de la Côte d'Azur — *March-August 2023*

- Martin Jose: Energy and momentum transfer in between particles and Kelvin waves

Reviewer for scientific journals

American Physical Society

- Physical Review Letters
- Physical Review B
- Physical Review A
- Physical Review Fluids

Publications

[1] **N. P. Müller**, C. Gissinger, and F. Pétrélis. Magnetic reversals in a geodynamo model with a stably-stratified layer. *arXiv:2508.17777* (2025).
[2] **N. P. Müller** and G. Krstulovic. Lack of self-similarity in transverse velocity increments and circulation statistics in two-dimensional turbulence. *Physical Review Fluids* **10**, L012601 (2025).
[3] **N. P. Müller** and G. Krstulovic. Exploring the equivalence between two-dimensional classical and quantum turbulence through velocity circulation statistics. *Physical Review Letters* **132**, 094002 (2024).
[4] **N. P. Müller**, Y. Tang, W. Guo, and G. Krstulovic. Velocity circulation intermittency in finite-temperature turbulent superfluid helium. *Physical Review Fluids* **7**, 15 (2022).
[5] **N. P. Müller** and G. Krstulovic. Critical velocity for vortex nucleation and roton emission in a generalized model for superfluids. *Physical Review B* **105**, 014515 (2022).
[6] J. I. Polanco, **N. P. Müller**, and G. Krstulovic. Vortex clustering, polarisation and circulation intermittency in classical and quantum turbulence. *Nature Communications* **12**, 7090 (2021).
[7] **N. P. Müller**, J. I. Polanco, and G. Krstulovic. Intermittency of Velocity Circulation in Quantum Turbulence. *Physical Review X* **11**, 011053 (2021).
[8] **N. P. Müller** and G. Krstulovic. Kolmogorov and Kelvin wave cascades in a generalized model for quantum turbulence. *Physical Review B* **102**, 134513 (2020).
[9] **N. P. Müller**, M.-E. Brachet, A. Alexakis, and P. D. Mininni. Abrupt Transition between Three-Dimensional and Two-Dimensional Quantum Turbulence. *Physical Review Letters* **124**, 134501 (2020).
[10] B. Moretti, **N. P. Müller**, M. Wappner, and H. E. Grecco. Compact and reflective light-sheet microscopy for long-term imaging of living embryos. *Applied Optics* **59**, D89–D94 (2020).

Invited talks and visits

Invited talk at CNR Nanotec — *Lecce, Italy*
Contact: Prof. Alessandra Lanotte — *1 - 3 October 2025*
Title: *Energy cascades and intermittency in two-dimensional quantum turbulence.*

Invited talk at LPENS — *Paris, France*
Contact: Dr. Anxo Biasi — *17 October 2023*
Title: *Intermittency of velocity circulation in quantum turbulence.*

Scientific visit at University of Tor Vergata — *Rome, Italy*
Contact: Prof. Luca Biferale — *13 June 2022*
Title: *Intermittency of velocity circulation in quantum turbulence.*

Participation in international conferences

- **28$^{\text{th}}$ Rencontre du non-linéaire** - Paris, France (March 2025)
  Poster presentation: *Polarity reversals in geodynamo model with a stably-stratified layer*.
- **Dynamics Days** - Buenos Aires, Argentina (December 2024)
  Oral presentation: *Polarity reversals in geodynamo model with a stably-stratified layer*.
- **Physics of Wave Turbulene and Beyond** - Les Houches, France (September 2024)
  Poster presentation: *Polarity reversals in geodynamo model with a stably-stratified layer*.
- **27$^{\text{th}}$ Rencontre du non-linéaire** - Paris, France (March 2024)
  Poster presentation: *Polarity reversals in geodynamo model with a stably-stratified layer*.
- **Mathematical Aspects of Geophysical and Astrophysical Fluid Dynamics** - Newcastle, England (January 2024)
  Poster presentation: *Anomalous scaling of velocity circulation in quantum turbulence*.
- **GDR Turbulence** - Paris-Saclay, France (October 2023)
  Oral presentation: *Are 2D classical and quantum turbulence equivalent? Insights from velocity circulation statistics*.
- **Bridging Classical and Quantum Turbulence** - Cargèse, France (July 2023)
  Oral presentation: *Are 2D classical and quantum turbulence equivalent? Insights from velocity circulation statistics*.
- **26$^{\text{th}}$ Rencontre du non-linéaire** - Paris, France (March 2023)
  Oral presentation: *Vortex clustering, polarisation and intermittency of velocity circulation in quantum turbulence*.

- **School on Nonlinearity, complex phenomena and universality for waves** - Porquerolles, France (May 2022)
  Poster presentation: *Anomalous scaling of velocity circulation in quantum turbulence*.
- **Quantum Fluids School** - São Carlos, Brazil (February 2022)
  Poster presentation: *Anomalous scaling of velocity circulation in quantum turbulence*.
- **GDR Turbulence** - Paris-Saclay, France (October 2021)
  Oral presentation: *Intermittency of velocity circulation in classical and quantum turbulence*.
- **WINE Conference** - Online (July 2021)
  Poster presentation: *Kolmogorov and Kelvin wave cascades in quantum turbulence*.
- **UK Quantum Fluids Webinar Series** - Online (July 2021)
  Oral presentation: *Intermittency of velocity circulation in quantum turbulence*.
- **24$^{\text{th}}$ Rencontre du non-linéaire** - Paris, France (March 2021)
  Poster presentation: *Intermittency of velocity circulation in quantum turbulence*.
- **StatPhys 27** - Buenos Aires, Argentina (July 2019)
  Oral presentation: *Critical transition between 2D-3D flows in quantum turbulence*.

Public Outreach

Night of the ENS in Paris — *École Normale Supérieure, France*

Collaborator in the Fluid Dynamics Exposition — *September 2024*

- The *Nuit de l'ENS* organized by the École Normale Supérieure in Paris is an outreach scientific activity oriented to high school students. I collaborated with the experimental demonstration in the Fluid Dynamics Exposition.

Physics Week — *University of Buenos Aires, Argentina*

Expositor in Fluid Dynamics Stand — *August 2018*

- The Physics Week organized by the University of Buenos Aires is an outreach scientific activity oriented to high school students. I collaborated with the experimental demonstration in the Fluid Dynamics Stand.

Skills

Computational Fluid Dynamics: Parallel computing (OpenMP and MPI), FFTW, SHTns, pseudo-spectral methods

Programming languages: Python - Fortran - Julia - Matlab - Vim - LaTeX - Bash

Languages: Spanish (*Native*) - English (*Fluent*) - French (*Advanced*) - German (*Intermediate*) - Italian (*Basic*)