Juan Pablo Carrillo-Mora

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Education

PhD. in Physics | *Universitat de Barcelona* 2024–Current
Barcelona, España

MSc. in Physics | *Universidad de Chile* 2021–2023
(Honors: summa cum laude) Santiago, Chile

BSc. in Physics | *Universidad Católica del Maule* 2017–2021
(Honors: summa cum laude) Talca, Chile

Fellowships and Awards

FPI predoctoral contract | *Agencia Estatal de Investigación and ESF+* 2024–Current
Salary for PhD. degree

Doctoral Scholarship | *Agencia Nacional de Investigación y Desarrollo (ANID)* 2024–Current
Full tuition funding and salary for PhD. degree

National Master Fellowship | *Agencia Nacional de Investigación y Desarrollo (ANID)* 2022–2023
Full tuition funding and salary for MSc. degree

DFI Schollarship | *Departamento de Física, FCFM, Universidad de Chile* 2021
Tuition funding for MSc. degree

Outstanding Student | *Universidad Católica del Maule* 2021
Award for outstanding academic performance in undergraduate degree

Honors Scholarship | *Universidad Católica del Maule* 2018–2020
Full funding of undergraduate tuition for outstanding academic performance

Research Experience

PhD. Thesis Project | *Universitat de Barcelona* 2024–Current
Research funded by *Agencia Estatal de Investigación (AEI)*
and *European Social Fund Plus (ESF+)*

- Non-equilibrium statistical physics of dense systems of active and chiral particles
- Transport and phase transitions in self-aligning active Brownian particles systems
- Dynamic self-assembly of actuated magnetic colloids in liquid interfaces

Other Projects | *Laboratory of Out-of-Equilibrium Matter, Universidad de Chile* 2023–Current
Research funded by *Millennium Nucleus Physics of Active Matter*

- Clustering of active particles in narrow microchannels
- Bio-convection patterns formed by magnetotactic bacteria
- Collective dynamics of confined self-aligning polar active agents
- Motility induced phase separation in evolving domains

MSc. Thesis | *Universidad de Chile* 2021–2023

Research funded by *Millennium Nucleus Physics of Active Matter* and *Agencia Nacional de Investigación y Desarrollo (ANID)*

- Effects of confinement on the motility of bacteria in synthetic soils
- Active diffusion of soil bacteria in disordered porous media
- Effects of shear flows on the motility and self-agglutination of soil bacteria

Undergraduate Project | *Universidad Católica del Maule* 2020–2021

Research funded by *Vicerrectoría de Investigación y Postgrado (VRIP)*

- Entropy production by transmembrane ionic flows in electrically excitable cells

Publications

1. J.P. Carrillo-Mora*, E. Rosas* and I. Bordeu. Optimal collective transport of constrained self-aligning active particles. Manuscript in preparation.
2. M. Pires-Monteiro*, J.P. Carrillo-Mora*, A.R. Lodeiro, V.I. Marconi and M.L. Cordero. Active diffusive fronts in disordered porous media. Manuscript in preparation.
3. J.P. Carrillo-Mora and C. Paiva-Sánchez. Entropy production due to transmembrane ion fluxes in excitable cells. Manuscript in preparation.
4. J.P. Carrillo-Mora, M. Pires-Monteiro, V. Marconi, M.L. Cordero, R. Brito and R. Soto. Preventing clustering of active particles in microchannels. Manuscript submitted for publication.
5. J.P. Carrillo-Mora, M. Pires-Monteiro, A.R. Lodeiro, V.I. Marconi and M.L. Cordero. Flagellar damage and recovery in soil bacteria exposed to shear in long microchannels. Manuscript in preparation. Pre-print (arXiv): 2410.10932.
6. M. Pires-Monteiro, J.P. Carrillo-Mora, N. Gutiérrez, S. Montagna, A.R. Lodeiro, M.L. Cordero and V.I. Marconi. (2023). Soils-on-a-chip reveal unforeseen motility parameters of microconfined *Bradyrhizobium diazoefficiens*. Manuscript submitted for publication. Pre-print (bioRxiv): 2023.12.29.573673.

* Equal contribution.

Teaching Experience

Teacher 2024

Universitat de Barcelona

- **Courses:**
  - TER-L20 Thermodynamics (Lab)

Teacher Assistant 2021–2023

Universidad de Chile

- **Courses:**
  - FI2003 Experimental Methods
  - FI6030 Introduction to Microfabrication Techniques

Teacher 2021

Universidad Católica del Maule

- **Courses:**
  - PBM-423 Physics and Chemistry II

Teacher Assistant 2018–2020

Universidad Católica del Maule

- **Courses:**
  - PCI-111 Natural Sciences (physics module)
  - CCI-123 Physics I
  - IND-212 Physics I
  - PCI-123 General Physics I
  - PCM-321 Physics
  - TME-124 Physics in Medical Technology (laboratory)
  - QYF-125 Physics Applied to the Pharmaceutical Sciences
  - PCM-311 Electromagnetism

Schools and Workshops

XI GEFENOL Summer School on Statistical Physics of Complex Systems 2023
· Organized by *GEFENOL & UBICS, Universitat de Barcelona*
· Presented a talk titled "Measuring motility of soil bacteria in a microfluidic porous media model"

XXIII Simposio Chileno de Física 2022
· Organized by *Sociedad Chilena de Física*
· Presented a poster titled "*Effects of shear on the motility of soil bacteria Bradyrhizobium diazoefficiens*"

School and Conference Physics of Active Matter 2022
· Organized by *Millennium Nucleus Physics of Active Matter*
· Presented a poster titled "*Effects of shear on the motility of soil bacteria Bradyrhizobium diazoefficiens*"

WE-Heraeus Summer School 2022 Active Matter and Complex Media 2022
· Organized by Université Grenoble Alpes, Universität Bayreuth, Institut d'Etudes Scientifiques de Cargèse
· Talk titled "*Measuring motility of soil bacteria in a microfluidic porous media model*"

XXI Meeting of Surfaces and Nanostructured Materials (NANO2022) 2022
· Organized by *Universidad Nacional de Río*
· Talk titled "*Soils on a chip: new tools for sustainable agronomy*"

APS March Meeting 2022 2022
· Organized by *American Physical Society*
· Talk titled "*Visualization and modeling of soil bacteria under confinement* "

107a Reunión de la Asociación Física Argentina 2022
· Organized by *Asociación Física Argentina*
· Poster titled "*Analysis of the motility parameters of soil bacteria in artificial microdevices*"

The Physics of Life Online Summer School 2020
· Organized by *Princeton University*
· Introduction frontiers topics in biological physics and active matter

Skills

- **Languages:** Spanish, English.
- **Coding:** Python, MATLAB, C, LaTeX.
- **Software:** FIJI (ImageJ), BioTracker, AutoCAD, Fusion360, Adobe Illustrator.
- **Experimental:** Maskless optical lithography, Soft lithography, Bright-field and fluorescence optical microscopy, Bacterial culture, Particle tracking.

Interests

- **Academic Interests:** Active Matter, Biophysics, Microfluidics, Non-equilibrium Statistical Physics.

References

María Luisa Cordero
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Universidad de Chile

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Condensed Matter Physics Department & UBICS
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