

# Alejandro Zamorano

Ph.D. Candidate in Physics

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Santiago, Chile

## EDUCATION

### Ph.D. in Physics

2022 – July 2026

University of Chile, Santiago, Chile

Thesis: "*Analysis of Complex Networks on Forced-Dissipative Systems: Self-Organized Criticality on Solar Flares.*"

Supervisor: Dr. Víctor Muñoz & Dra. Denisse Pastén

### B.Sc. in Physics

2021

University of Chile, Santiago, Chile

## RESEARCH EXPERIENCE

### Research Technical Personnel

2018 – Present

FONDECYT Projects: #1161711 (2018-2024), & #1201967 (2024-Present) with Dr. Víctor Muñoz: **Non-linear Phenomena in Magnetized Plasmas: An Study on Solitons and Geomagnetic Storms & Time Series and Complex Networks Approaches for Nonlinear Processes in Spaces Plasmas** #1210353 (2022) with Dr. Marcel Clerc: **Transition to Complex Spatiotemporal Dynamics: Theory & Experiments.** University of Chile, Santiago, Chile

- Developed numerical methods and data analysis techniques for nonlinear dynamics in astrophysics.
- Implemented and analyzed complex network models for solar flare statistics.
- Developing a model of solar flares using self-organized criticality and topological changes.
- Investigated magnetic field topology evolution in solar active regions over the 22-year solar cycle.

## PUBLICATIONS

- Flández, E., **Zamorano, A.**, & Muñoz, V. (2025). A 22 yr Cycle of the Network Topology of Solar Active Regions. *The Astrophysical Journal*, 980(1), 4.
- **Zamorano, A.**, Morales, L., Pastén, D., & Muñoz, V. (2025). Lu and Hamilton Model for Solar Flare over a Rewiring Complex Network. *The Astrophysical Journal*, 994(2), 257.
- **Zamorano, A.**, Muñoz, V. Effect of rewiring for a sandpile model on a directed network. (Under Review *Chaos, Solitons & Fractals* 2026).

## ADDITIONAL TRAINING

### Introduction to Fusion Energy and Plasma Physics Course

2024

Princeton University, Plasma Physics Laboratory (Online)

### Non-Equilibrium Statistical Physics

2026

University of Maryland (Prof. Christopher Jarzynski), University of Chile, Faculty of Chemical and Pharmaceutical Sciences.

## CONFERENCE PRESENTATIONS

### Invited Talks (2)

- "From Sandpiles to Complex Networks to Solar Flares", Università della Calabria, Italy (2025)
- "A Solar Pasta: from Magnetic Field Lines to Solar Flares", Física en las Palmeras Seminar (2024 & 2025)

### Contributed Talks (5)

- XXIV Simposio Chileno de Física SOCHIFI (2024)

- 21st International Congress on Plasma Physics, ICPP (2024)
- Conference on Complex Systems: Physics of Self-Organization in Complex Systems (2025)
- Primer Congreso Chileno de Física de Plasmas (2023)
- SOCHIFI Symposium (2022)

#### Poster Presentations (16)

- 9th Asia-Pacific Conference on Plasma Physics, AAPPS-DPP (2025)
- 5th Meeting of the Italian Solar and Heliospheric Community, SoHe-5 (2025)
- Conference on Complex Systems (2025)
- 17th Latin American Workshop on Plasma Physics (2025)
- Dynamics Days Latin America and the Caribbean (2024)
- XIV Latin American Conference on Space Geophysics, COLAGE (2024)
- International Workshop on Statistical Physics, IWOSP (2023)
- Primer Congreso Chileno de Física de Plasmas (2023)
- European Physical Society Conference (2022)
- 11th International Conference on Complex Networks and their Applications (2022)
- XIII Latin American Conference on Space Geophysics, COLAGE (2022)
- 6th Asia-Pacific Conference on Plasma Physics (2022)
- International Workshop on Statistical Physics, IWOSP (2021)
- 10th International Conference on Complex Networks and their Applications (2021)
- Latin American Conference on Space Geophysics (2021)
- Sociedad Chilena de Física, SOCHIFI (2020)

### TEACHING EXPERIENCE

#### Teaching Assistant

2019–2024

Department of Physics, University of Chile

- **Graduate Courses:** Electrodynamics, Statistical Mechanics, Classical Mechanics
- **Undergraduate Courses:** Classical Mechanics, Quantum Mechanics I, Electrodynamics, Statistical Mechanics, Mathematical Methods II, Programming & Advanced Numerical Methods, Thermodynamics, Contemporary Physics II, Introduction to Mechanics

### GRANTS AND AWARDS

- **ANID National Ph.D. Scholarship #21231335** 2022–2026
- **Internship Grant**, Università della Calabria, Italy (ANID) 2025
- **Short Internship Grant** (PSPC - ACAL), Universidad de Buenos Aires, Argentina 2025
- **Poster Award**, Primer Congreso Chileno de Física de Plasmas 2023

### TECHNICAL SKILLS

- **Programming:** C++ (Advanced), Python (Advanced), Bash (Intermediate), Wolfram Mathematica (Intermediate), MATLAB (Basic)
- **Research Methods:** Nonlinear Dynamics, Complex Networks, Numerical Simulations, Data Analysis, Statistical Physics, Magnetohydrodynamics.
- **Solar Physics Data:** SDO/HMI, HEK Database, RHESSI.
- **Languages:** Spanish (Native), **English (Fluent)**, Italian (Basic), Portuguese (Basic).

### PROFESSIONAL MEMBERSHIPS

- Complex Systems Society (2025)
- Asia-Pacific Plasma Physics Society (2025)

### SCIENCE COMMUNICATION & MEDIA

#### Interview Feature

“ **ENG Ver.:** University of Chile researchers discover a hidden pattern that repeats every 22 years in the Sun’s explosive activity // **ESP Ver.:** Investigadores U. de Chile descubren un patrón oculto que se repite cada 22 años en la actividad explosiva del Sol”

*Universidad de Chile* | November 2025

[link interview](#)