



# Armando Imanol Mancilla Bustos

PHYSICS STUDENT \*  
COMPUTATIONAL MODELING  
& DATA ANALYSIS  
\*Expected graduation: 2025.

## CONTACT

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## EDUCATION

**B.S. in Physics, Universidad de Guadalajara**  
Guadalajara, Mexico. Expected graduation: 2025.  
Current Average: 89/100.

## SKILLS

**Programming:** Python (NumPy, Pandas), Fortran (OpenMP), MATLAB/SCILAB  
**Data Tools:** Jupyter Notebook, Git, Matplotlib, LaTeX  
**Concepts:** Stochastic Modeling, Monte-Carlo Methods, Time-Series Analysis  
**Languages:** Spanish (Native), English (Fluent)

## RESEARCH PROJECTS

### Random Walks in Annihilation Dynamics

August 2024 to the present

- Advised by Dr. Thomas Gorin and Dr. Soham Biswas.*
- Built a parallelized Fortran program (OpenMP), for large-scale stochastic systems for 2,000 interacting particles, automating data storage.
  - Designed a data reduction strategy in Python/Jupyter, compressing output files while preserving key dynamics for analysis.
  - Analyzed asymptotic behavior, proposing an empirical fit and qualitative model for particle diffusion and its impact on long-term concentration decay.

### Computational Simulation of Thermodynamic Systems

Professional Practices. February 2024 to June 2024

- Educational tool development under Dr. Gorin | SciLab (MATLAB alternative)*
- Developed a simulator modeling systems of gas particles using stochastic sampling methods (Metropolis-Hastings, Monte Carlo) to analyze emergent properties.
  - Optimized algorithmic efficiency to handle 50+ particle systems, balancing real-time performance with accuracy.
  - Designed for classroom demonstration, automating data visualization, enabling instructors to visualize system behavior. Allowing intuitive interpretation of non-ideal dynamics.
  - Created teacher-focused documentation, including use-case examples and theoretical background.

### Random Walk with Resetting and Self-Memory Effects

PRO-SNI Scholarship. December 2022 to June 2023

- Advised by Dr. Thomas Gorin and Dr. Soham Biswas.*
- Modeled 100K+ random walkers stochastic systems with resetting/memory, automating data generation, using high-performance Fortran.
  - Identified critical thresholds between diffusive/subdiffusive dynamics and developed differential models with solutions to predict system behavior.
  - Analyzed data using Python/Jupyter, creating visualizations (distributions, variance) revealing key dynamical differences for memory and resetting cases.

### Epidemic Models for Herd Immunity & Social Distancing

PRO-SNI Scholarship. May 2021 to September 2021

- Collaborative research under Dr. Thomas Gorin.*
- Implemented and extended a dynamic epidemic model (Python/Pandas) to analyze COVID-19 waves in Mexico, processing CONACYT-provided data (2 years of records).
  - Led data cleaning and wave detection, developing Jupyter Notebooks to document methodology and visualize trends.
  - Estimated parameters for infection rate dynamics, comparing results against SIR model benchmarks. Working closely with Dr. Gorin to refine model assumptions.
  - Analyzed model outputs to explain real-world phases (e.g., lockdown timing and herd immunity effects on wave decay).

## ACADEMIC PRESENTATIONS

**Random Walks with Relocation and Memory Dynamics**  
Poster | *Meeting on Complex Systems & Stochastic Processes*  
Guadalajara, Mexico. July 2024.