David Gonzalez-Calatayud

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Research Interests

Soft Matter, Complex Systems, Statistical Physics, Biophysics, Self-Organization, Self-Replication

Education

Autonomous University of Madrid Sep 2020 – Jan 2025 (expected)
B.Sc. in Physics, GPA: 8.68/10 Madrid, Spain

- Relevant Courses: Computational Physics, Mathematical Methods, Statistical Mechanics, and Nonlinear Dynamics and Pattern Formation.
- Bachelor thesis: Smart magnetic microrobots learn to roll with deep reinforcement learning

Boston University Sep 2023 – Dec 2023
Visiting Student Boston, USA

- Exchange student for Fall 2023, supported by BU-UAM Faculty of Science Scholarship.

Heidelberg University Oct 2022 – Aug 2023
Visiting Student Heidelberg, Germany

- Erasmus exchange student for the Academic Year 2022/23.

Experience

National Center for Biotechnology Oct 2024 – Present
Research Assistant Madrid, Spain

- Working on neuromorphic computing algorithms applied to biological problems, supported by JAE Intro Scholarhsip.
- Supervisor: Dr. Luis Seoane

Condensed Matter Physics Center (IFIMAC) Jan 2024 – Sep 2024
Research Assistant Madrid, Spain

- Developed smart, magnetic-driven microrobots using deep reinforcement learning for navigation tasks. Built an experimental setup with a GUI for real-time particle tracking and magnetic actuation control. Successfully trained the microrobots to roll by harnessing lubrication forces, and characterized the influence of the Brownian motion in the learning process.
- Paper *in preparation*.
- Supervisor: Prof. Juan Luis Aragones

Heidelberg University May 2023 – Aug 2023
Research Assistant Heidelberg, Germany

- Introduced an elastic term into a phase-field method for substrate-based cell motility.
- Supervisor: Dr. Falko Ziebert

Research Projects

Asset Exchange Model with Economic Growth and Wealth Distribution on a Network Oct 2023 – Dec 2023

- Applied methods of equilibrium statistical mechanics to study the wealth distribution and economic mobility in an asset exchange model across various network distributions.
- Supervisor: Prof. William Klein

Study of the distribution of EV charging stations in Madrid using Voronoi diagrams Jan 2019 – Jan 2020

- Research project under the *Baccalaureate of Excellence* High School Program.
- Developed a model using Voronoi diagrams to determine the location of electric vehicle (EV) charging stations in Madrid. The model informed a city's decision on a new EV charging station location.
- Received multiple pre-university research awards, and was featured on local TV (Telemadrid, in Spanish).

Conferences, Presentations and Schools (*scheduled)

***Poster**, GEFES Conference, Oviedo, Spain	Jan 2025
Contributed talk, III FisEs Joven, Virtual	Nov 2024
Contributed talk, 2nd Spanish Soft Matter 1 1/2 Day, Benasque, Spain	Nov 2024
Summer School, GEFENOL's School on Statistical Physics of Complex Systems, 2 weeks, Madrid, Spain	Jul 2024

Awards and Scholarships

Interdisciplinary Mathematics Institute, 3rd Accésit at the VII Mathematical Modeling Contest [link]	Nov 2024
Spanish National Research Council, JAE Intro Scholarship ($4,200)	Jul 2024
Condensed Matter Physics Division-RSEF, Research Awards for Undergraduate Students ($750) [link]	Jun 2024
Boston University, BU-UAM Faculty of Science Scholarship ($4,500)	Sep 2023
Community of Madrid, Excellence Scholarship ($2,100)	Jul 2021
Autonomous University of Madrid, Young Talent Awards	Jun 2021
Magma, 2nd Prize at the XXII Exporecerca Jove [video]	Feb 2021
URANIA, Special Prize to the Best Project Related to Biodiversity and Environmental Protection	Jan 2021
Spanish Ministry of Universities, 2nd Prize at the XXXII Young Researchers Contest ($3,000) [link]	Dec 2020
Pintor Antonio Lopez High School, Honourable Mention	Jul 2020
Spanish Royal Physics Society, Silver Medal in the XXXI Spanish Physics Olympiad	Jul 2020
Madrid Chemistry Society, Honorable Mention in the Madrid Chemistry Olympiad	Mar 2020

Volunteering and Service

Workshop Organizer and Presenter — Jun 2024
Helped organize and present a series of talks showcasing our bachelor thesis projects to younger physics students at the Autonomous University of Madrid. — Madrid, Spain

Student Representative — 2021-2022
Elected to be student representative of the 2nd-Year Physics Class. — Madrid, Spain

Physics Olympiads Tutor — 2021
Mentored and trained a group of high school students to prepare for the Physics Olympiads. — Madrid, Spain

Technical Skills

Programming Languages: Python, MATLAB, C++
Python libraries: NumPy, SciPy, Matplotlib, NetworkX, OpenCV, Threading, Gymnasium, StableBaselines3
Others: Linux, Bash, Slurm, Git, Tmux, LaTeX

Language Proficiency

English (fluent), **Spanish** (native), **German** (conversational)

Last updated on January 6, 2025. Certificates, references and transcripts available upon request.