Jonathan Lozano

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Weinberg Institute, University of Texas

Education

2023 – present **PhD.Physics**, University of Texas at Austin - USA

GPA: 3.87/4

2016 – 2021 **BSc.Physics**, National Autonomous University of México - Coyoacan, Mexico City, Mexico
GPA: 9.39/10.0, Graduated with High Honors.

Advisor Dr. Manuel Torres Labansat

Four and a half year long bachelor involving general physics courses and including selected topics in advanced physics from which I took two graduate courses in **quantum field theory** and a course in **differential geometry and topology for physicists** among others.

Thesis *Spontaneous symmetry breaking and extended field configurations in a scalar theory subject to a potential with two families of vacuum states*

Awards and distinctions

2022 **DPG/IAPS-PLANCKS Munich Travel Grant**

Awarded a travel grant to attend to the PLANCKS competition in Munich at the LMU.
`https://www.iaps.info/plancks/what-is-plancks/`

2022 **Winner of the PLANCKS 2022 mexican preliminary**

Placed **1st** out of 30 in the Mexican tournament of physics, a national theoretical physics competition for bachelor's and master's students (Torneo Mexicano de Física).

2021 **Awarded the 2021 *Juan Manuel Lozano Mejia* Diploma**

Given by the Institute of Physics of the National Autonomous University of Mexico to the students with the most outstanding achievements during their thesis research.

2021 **Excellence Cluster scholarship (PRISMA/Johannes Gutenberg Universität Mainz)**

2021 **Top 10 in the international theoretical physics competition PLANCKS Porto**

Placed **7th** out of 50 participant teams

2021 **Winner of the PLANCKS 2021 mexican preliminary**

Selected as member of the **first mexican team** to attend to the PLANCKS competition after placing **1st** in the Mexican Tournament of physics.

2021 **"Honorific mention", BSc. Physics Thesis defense (UNAM)**

Achieved the highest honor after successfully defending my BSc thesis.

2019 **IF-UNAM research assistant**

Enrollment as research assistant at the Physics Institute of the National Autonomous University of Mexico.

2018 **AMC-Scholarship**

Mexican Academy of Sciences scholarship to attend the XXVIII Scientific Research Summer.

2018 **ICF-UNAM Scholarship**

Physical Sciences Institute of the National Autonomous University of Mexico scholarship to attend the VII Experimental Physics School.

2017 **IF-UNAM Scholarship**

Physics Institute of the National Autonomous University of Mexico scholarship to attend the XXV Physics School.

Publications

2025 JJ Ziegler, K Freese, **J Lozano**, G Montefalcone, (2025). *Explaining the" too massive" high-redshift galaxies in JWST data: numerical study of three effects and a simple relation*. **(In revision)**

2024 **J. L. Mayo** and M. Torres, (2024). *Multi-kinks in scalar field theories with non-degenerate vacua: the modulated double Sine-Gordon model*. **(In revision)**

2021 **J. Lozano-Mayo** and M. Torres-Labansat, *Kink solutions in a generalized scalar ϕ^4_G field model*, J. Phys. Comm. 5 (2021) 025004 https://doi.org/10.1088/2399-6528/abdd83

Professional Presentations

May 2025 **J. L. Mayo**. *$h - D^0$ angular correlations and ΔROF performance studies at ITS2*. ALICE USA Meeting.

October 2021 **J. L. Mayo**. *Multi-solitones en teorías escalares de campo con vacíos no-degenerados: el modelo doble de Sine-Gordon*. LXVI National Physics Congress. Mexican Physical Society.

Research Experience

2025 **$h - D^0$ angular correlations**

Advisor: Prof. Christina Markert

We use ALICE Run3 Pb-Pb collisions to study the properties of charm production in different colored environments by taking the azimuthal angle difference between a high momentum trigger hadron and a lower momentum associated D^0 meson.

2024 **JWST early massive galaxies and Top-Heavy IMF's**

Advisor: Prof. Katherine Freese

We modeled a variety of spectral energy distributions of galaxies by using the population synthesis code Pegase to constrain the parameter space for which the JWST observations of high-redshift galaxies are consistent with the standard Λ_{CDM} model.

2021-2022 **Multi-kinks in scalar field theories with non-degenerate vacua**

Advisor: Dr. Manuel Torres Labansat

We studied the phenomenology of the formation of static structures with n kinks in models with deformed potentials. In order to study the binding forces between kinks, I performed numerical simulations in the programming language Julia. Additionally, I found an analytical relation for the energy of the static multikink. There's an article in preparation reporting our findings, and we plan to extend our study to higher-dimensional topological structures.

2020-2021 **One-loop quantum renormalization of the kink masses, forces between kinks and virial relations**

I studied the emergent phenomena in the behavior of the kink configurations arising from the topology of a generalized ϕ^4 potential. During this project, I used perturbation techniques in order to renormalize the quantum mass correction of a kink configuration. By using asymptotic analysis, we proved the existence of static multikink configurations and developed the framework to understand the stability of such fields.

2018-2019 **Photon wave function**

I studied the possibility of having a well-defined photon wave function starting from the photon's dispersion relation and then letting the theory go, checking for consistency. The appropriate quantum operators and Lorentz transformations were constructed by using **elements of group theory** to find the representations acting on the proposed 6-component wave function. After obtaining the Lagrangian density, the expected symmetries of the theory were examined. I worked under the tutelage of Dr.Manuel Torres Labansat at the Physics Institute of the National Autonomous University of Mexico.

2019 **Mass spectrometry**

A collision between protons and air particles was produced using a Low-Energy linear collider. The products of the reaction were analyzed using the time-of-flight mass spectrometry technique under the tutelage of Dr.Juan Lopez Patiño at the Science Faculty of the National Autonomous University of Mexico.

Academic Experience

2025 **Lecturer: Quantum Field Theory I - ICTP**

Introduction to Quantum field theory taught as part of the Physics Without Frontiers initiative of the International Center for Theoretical Physics

2024 **Teaching assistant: Advanced Particle Physics-ICTP**

Advanced topics in quantum field theory

I led problem set discussions and graded the assignments.

2024-2025 **Teaching assistant: Modern Physics-UT Austin**

Undergraduate modern physics course

I graded and led a weekly discussion involving select topics on statistical mechanics, quantum mechanics, and special relativity.

2023 **Teaching assistant: PHY 105N-UT Austin**

Undergraduate-level E&M lab

I led two weekly lab discussions and helped with the experimental setups.

2022 **Referee**

Reviewer for the *Journal of physics G: Nuclear and Particle physics*.

Referee record: `https://orcid.org/0000-0002-9638-5173`

2020 **Teaching assistant: Nuclear and sub-nuclear physics-UNAM**

Undergraduate level Nuclear and subnuclear physics course taught by Prof. Manuel Torres Labansat

I mentored students, graded homework and exams.

2022 **Teaching assistant: Thermodynamics-UNAM**

Undergraduate-level thermodynamics course, taught by Prof. Juan Valentin Escobar Sotomayor and MSc. Ivan Hernandez Garibay.

I mentored students, held problem-solving sessions, created and graded homework and exams.

Volunteer Work

2017 **Teacher**

Physics and mathematics teacher in an undergraduate preparation course at the Humanities and Sciences School of the National Autonomous University of Mexico.

Research Interests

- Topological phases of matter
- Quantum phenomena
- Effective field theory
- Topological and Non-topological solitons
- Heavy flavor physics

Additional Training

2022 **Summer school on modeling and tools for data analysis in science - UANL**

2021 **Bad Honnef Physics School - DPG**

Methods of Effective Field Theory and Lattice Field Theory

2021 **VII Mexican School on String Theory and supersymmetry (MSSS) - UG**

2021 **Mexican Astro-Particle School (MAPS) - UG**

Technical Skills

Data analysis and Programming: Julia, Python,C++, Mathematica, QtiPlot, Origin, Tracker, Latex, basic HTML, ImageJ, O^2

Languages

C1 **English**

Native **Spanish**

A2 **German**

A2 **French**