

# Patrícia Muñoz Ewald — CV

✉ ewald@utexas.edu

## Research interests

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Mathematical foundations of deep learning, mathematical physics, geometric analysis.

## Education

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- **Ph.D. in Mathematics** (in progress) 2021 – 2026  
○ *University of Texas at Austin* Austin, TX, USA
- **M.Sc. in Mathematics** 2019 – 2021  
○ *University of São Paulo - USP* São Paulo, Brazil
- **B.Sc. in Physics** 2015 – 2018  
○ *University of São Paulo - USP* São Paulo, Brazil

## Projects

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- **Geometric aspects of ReLU neural networks**  
Ongoing work with Prof. Thomas Chen (UT Austin) aiming to get rigorous mathematical understanding of fully connected feedforward ReLU neural networks. **Preprints:**
  - Geometric structure of shallow neural networks and constructive  $\mathcal{L}^2$  cost minimization, *arXiv:2309.10370*
  - Geometric structure of deep learning networks and construction of global  $\mathcal{L}^2$  minimizers, *arXiv:2309.10639*
  - Global minimizers for under-parameterized deep ReLU networks on sequentially separable data, *in preparation*
- **Compactness in gauge theory** 2019 – 2021  
○ *Master's thesis*  
I studied the proof of Uhlenbeck's weak and strong compactness theorems for sequences of connections on principal bundles with  $L^p$  bounds on curvature.

## Service and leadership

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- **Referee** Fall 2023  
○ *Journal of Machine Learning Research*
- **Co-Organizer** Fall 2022 – present  
○ *Distinguished Women in Mathematics Lecture Series* UT Austin
- **Mentor** Spring 2023 – present  
○ *Directed Reading Program* UT Austin
- **Organizer** Spring 2023  
○ *Junior Geometry Seminar* UT Austin
- **Organizer** Spring 2023  
○ *Microlocal Analysis Learning Seminar* UT Austin

## Selected talks

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- **Sunday Morning Math Group** Spring 2023  
○ *Outreach talk, UT Austin* Austin, TX  
Title: "Special relativity"
- **UT Math Club** Spring 2023  
○ *Outreach talk, UT Austin* Austin, TX  
Title: "Symmetric matrices and some of their uses in geometry and topology"

- UFES Math Seminar** **October 2021**  
*Invited talk, UFES* *Vitória, Brazil*  
 Talk given in a seminar aimed at a general audience from the math department at Federal University of Espírito Santo (UFES). Title: "Convergence of sequences in gauge theory."
- A5 Seminar** **September 2021**  
*Outreach talk, USP* *São Paulo, Brazil*  
 Talk given in a seminar aimed at upper division undergraduate students at University of São Paulo (USP). Title: "Why should you study gauge theory?"
- Theoretical Physics Winter School** **August 2021**  
*Invited mini-course, USP* *São Paulo, Brazil*  
 Five day mini-course "An introduction to mathematical gauge theory" given at a winter school organized by students and aimed at senior undergraduate physics students at the University of São Paulo (USP), "III Escola Jayme Tiomno de Física Teórica".

## Teaching experience

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Received a **Frank Gerth III Teaching Excellence Award** for outstanding work as a Teaching Assistant in May 2023 from the UT Austin Mathematics department.

- Teaching Assistant** **Fall 2023**  
*Matrices and Matrix Calculations* *UT Austin*
- Teaching Assistant** **Spring 2023**  
*Advanced Calculus for Applications II* *UT Austin*
- Teaching Assistant** **Fall 2022**  
*Integral Calculus* *UT Austin*
- Teaching Assistant** **Spring 2022**  
*Differential Equations with Linear Algebra* *UT Austin*
- Teaching Assistant** **Fall 2021**  
*Differential Equations with Linear Algebra* *UT Austin*
- Teaching assistant** **Winter 2020**  
*Geometric Calculus on  $\mathbb{R}^n$*  *University of São Paulo*

## Conferences attended

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- SLMath Summer School in Stochastic Quantization** **July 2024**  
*Participant, SLMath* *Berkeley, CA*
- Geometric Applications of Microlocal Analysis** **September 2022**  
*Participant, Stanford* *Palo Alto, CA*
- Analytic and Geometric Aspects of Gauge Theory** **Fall 2022**  
*Participant, MSRI* *Berkeley, CA*
- Global Categorical Symmetries Summer School** **June 2022**  
*Participant, Perimeter Institute* *Waterloo, Canada*
- International Conference on Poisson Geometry** **December 2019**  
*Participant, IMPA* *Rio de Janeiro, Brazil*
- School of Poisson Geometry** **December 2019**  
*Participant, IMPA* *Rio de Janeiro, Brazil*
- Workshop on Holomorphic Differentials in Mathematics and Physics** **November 2019**  
*Participant, MSRI* *Berkeley, CA*
- School of Symplectic Topology** **August 2019**  
*Participant, IMPA* *Rio de Janeiro, Brazil*
- 32<sup>nd</sup> Brazilian Mathematical Colloquium** **August 2019**  
*Participant, IMPA* *Rio de Janeiro, Brazil*

- **VII Workshop on Poisson Geometry and Related Topics**  
*Participant, Federal University of Paraná - UFPR*
- **IV Workshop on Geometry in Algebra and Algebra in Geometry**  
*Participant, USP*

**June 2019**  
*Curitiba, Brazil*

**November 2018**  
*São Paulo, Brazil*