

### Contact Information

Mathematical Sciences Building, Office 609  
Department of Mathematics, Purdue University

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### Education & Academic Background

<b>Doctor of Philosophy in Mathematics</b> Purdue University, West Lafayette, Indiana	May 2029
<b>Master of Science in Mathematics</b> Purdue University, West Lafayette, Indiana	May 2026
<b>Bachelor of Science in Pure Mathematics</b> ( <i>Magna Cum Laude</i> ) <b>Curricular Sequence in Applied Mathematics for Science and Engineering</b> University of Puerto Rico, Mayagüez Campus (UPRM), Mayagüez, Puerto Rico	December 2022

### Skills and Other Information

Programming & Computation: Python, Julia, C++, SageMath, MATLAB | Formatting & Tools: HTML, L<sup>A</sup>T<sub>E</sub>X, Git  
Math & AI/ML: NumPy, SciPy, PyTorch, Tensorflow, JAX, Flux, CUDA | Spoken Languages: English and Spanish

### Research Experience

<b>Research Intern in Dynamical Systems and Machine Learning</b> URA-Sandia Graduate Student Summer Fellowship & Oak Ridge Institute of Science and Education Computational & Information Sciences Foundation, Sandia National Laboratories, California Campus Supervised by: Dr. Moe Khalil, Sandia National Laboratories <i>Data-Driven Closure Models</i> <ul style="list-style-type: none"><li>Studied machine learning-based surrogate models, and learned and applied data assimilation for closure models.</li><li>Conducted a parametric study of the optimization step for noisy samples of an SIQR epidemic model.</li><li>Analyzed results with statistical techniques to understand the optimization value distribution of 100 samples of data.</li></ul>	May 2025–August 2025
<b>Research Intern in Machine Learning</b> MIT Lincoln Laboratory Summer Research Program (GEM Fellowship Employer Sponsor) Group 39, Division 3, MIT Lincoln Laboratory, Massachusetts Institute of Technology Supervised by: Dr. Sam Polk & Dr. Mabel Ramírez, MIT Lincoln Laboratory <i>Unsupervised Behavior Inference from Human Action Sequences (UNBIAS)</i> <ul style="list-style-type: none"><li>Developed mathematical algorithms for autoencoders with LSTM architecture.</li><li>Identified the autoencoder that minimized the loss function.</li><li>Optimized silhouette score and utilized K-medoids, PCA and other clustering techniques for encoded space analysis.</li></ul>	May 2023–August 2023
<b>Research Assistant in Number Theory</b> Puerto Rico Louis Stokes Alliance for Minority Participation Department of Mathematical Sciences, University of Puerto Rico, Mayagüez Campus Supervised by: Prof. Reyes M. Ortiz Albino, University of Puerto Rico at Mayagüez <i>Properties of <math>\tau_{(n)}</math>-primes</i> <ul style="list-style-type: none"><li>Research based on the theory of generalized factorizations in integral domains.</li><li>Generalized the notion of complete residue systems for <math>\tau_{(2)}</math>-primes, <math>\tau_{(3)}</math>-primes and <math>\tau_{(6)}</math>-primes.</li><li>Extended the Euler totient function to the notion of equivalence classes modulo a <math>\tau_{(n)}</math>-prime.</li></ul>	August 2019–December 2022
<b>Research Assistant in Combinatorics</b> Summer@ICERM 2022: Computational Combinatorics Institute for Computational and Experimental Research in Mathematics, Brown University Supervised by: Prof. Pamela E. Harris, University of Wisconsin-Milwaukee <i>Permutation Invariant Parking Assortments</i> <ul style="list-style-type: none"><li>Combinatorics research focused on the study of generalizations of parking functions.</li><li>Characterized car length sequence minimal invariance (case when the all-ones sequence is the only permutation invariant parking assortment). Characterized the form of the family of 2-tuple and 3-tuple parking assortments.</li></ul>	June 2022–August 2022

## **Research Assistant in Algebraic Coding Theory**

June 2021–August 2021

NSF REU in Combinatorics, Probability and Algebraic Coding Theory

East Tennessee State University & University of Puerto Rico at Ponce

Supervised by: Prof. Fernando Piñero González, University of Puerto Rico at Ponce

### *Improving the Dimension Bound of Hermitian-Lifted Codes*

- Algebraic Geometry research focused on the study of Hermitian-Lifted Codes.
- Developed a formula that improved the counting of good recoverable functions.
- Improved the bound rate of the code from 0.007 to 0.1.

### *Improving the Minimum Distance Bound of Trace Goppa Codes*

- Finite Fields research focused on the development of Goppa codes.
- Worked with Goppa matrices by using quadratic extensions and cubic extensions over finite fields.
- Improved the minimum distance bound of norm and trace Goppa polynomials.

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## **Projects**

### **Project in Numerical Differential Equations**

August 2025–December 2025

Purdue University, West Lafayette

MA57300: Numerical Solutions of Ordinary Differential Equations

Instructor: Prof. Di Qi, Purdue University

#### *Data Assimilation for the Lorenz 96 Model*

- Explored the topic of data assimilation using the Ensemble Kalman Filter for a toy 1-time scale Lorenz 96 Model.
- Compared results corresponding to ground truth state solutions with sampled data predictions.

### **Projects in Optimal Transport and Neural Networks**

January 2025–May 2025

Purdue University, West Lafayette

MA59500MM: Computational Optimal Transport and Deep Generative Models

Instructor: Prof. Rongjie Lai, Purdue University

#### *Normalizing Flows Optimal Transport implementation on MNIST Dataset*

- Developed a normalizing flow neural network that learned the optimal transport path of a Gaussian distributed MNIST image to the target MNIST number distribution.
- Generated recognizable digit images after training.

#### *WGAN and Monge Map implementation on MNIST Dataset*

- Constructed a Wasserstein Generative Adversarial Network with Gradient Penalty (WGAN-GP) and Monge Map Network and applied it to the MNIST dataset.
- Successfully generated realistic looking sample numbers at the end of training.
- Compared results between real images and generated images.

### **Project in Neural Networks and Dynamical Systems**

November 2024–December 2024

Purdue University, West Lafayette

MA59500MM: Introduction to Mathematical Modeling

Instructor: Prof. Alexandria Volkening, Purdue University

#### *Physics-Informed Neural Networks (PINNs) for Hurricane Trajectory Prediction*

- Exploration of PINNs research through data sets that model hurricane trajectories.
- Learned about the construction of loss functions with non-linear operators that model the physics behind the problem.

### **Project in Biotechnology**

June 2023–July 2023

MIT Lincoln Laboratory Summer Research Program

2023 MIT Lincoln Laboratory Intern Innovative Idea Challenge (I<sup>3</sup>C)

Supervised by: Ryan Burrow and Ashok Kumar, MIT Lincoln Laboratory

#### *SKINS: Skin-growth boosting and Intra-absorptive Solution bandages*

- Ranked Top 3 out of a total of 28 submitted proposals in the competition.
- Biotech research proposal submitted to the 2023 edition of the MIT Lincoln Laboratory I<sup>3</sup>C.
- Proposed a hydrogel bandage with accelerated wound healing and anti-scarring properties, based on the combination of Sodium Carboxymethyl Cellulose, BMM and Aloe vera.
- Estimated the materials cost, approximate bandage size, and compared performance of materials with standard antibiotics.

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## Awards and Merits

### Fellowships, Scholarships and Prizes

2025 Universities Research Association-Sandia National Labs Graduate Summer Fellowship	May 2025–August 2025
2023 National GEM Consortium PhD Science Fellowship	August 2023–May 2024
• Purdue University Department of Mathematics Sponsorship	August 2023–May 2024
• MIT Lincoln Laboratory Employer Sponsorship (Internship)	May 2023–August 2023
2023 MIT Lincoln Laboratory I <sup>3</sup> C 3 <sup>rd</sup> Place Research Proposal Prize	July 2023
2022 Evertec Inc. STEM Scholarship	October 2022
Puerto Rico-Louis Stokes Alliance for Minority Participation Research Scholarship	August 2019–December 2022

### Merits and Honors

2023 Ford Foundation Predoctoral Fellowship Honorable Mention	March 2023
2022 Hispanic Scholarship Fund Scholar	June 2022
National Math Alliance Predoctoral Scholar	November 2021
UPRM Faculty of Arts and Sciences Honor Roll	August 2018–May 2023
National Trig-Star Math Competition, 16th Overall Finalist	June 2017
Eagle Scout Rank, with 2 Silver Palms	May 2017

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## Papers and Articles

The asterisk symbol (\*) denotes alphabetical order authorship.

- [1] S. Polk, E.J. Pabon-Cancel, R. Paleja, K. Chestnut-Chang, R. Jensen and M. Ramirez.  
Unsupervised Behavior Inference from Human Action Sequences (UNBIAS). *2024 IEEE Conference on Games (CoG), Milan, Italy, 2024*, pp. 1-8.
- [2] \*A. Allen, E.J. Pabon-Cancel, F. Piñero-Gonzalez and L. Polanco.  
Improving the Dimension Bound of Hermitian-Lifted Codes. arXiv: <https://arxiv.org/abs/2302.01557>
- [3] \*D. Chen, P.E. Harris, J. Carlos Martinez Mori, E.J. Pabon-Cancel and G. Sargent.  
Permutation Invariant Parking Assortments. *Enumerative Combinatorics and Applications*, **4:1**, 1-25 (2024). #S2R4.
- [4] \*P.E. Harris, Z. Markman, L. Martinez, A. Mock, E.J. Pabón-Cancel, A. Verga, and S. Wang.  
A Model for a One-Hour Workshop on Mentoring. *MAA Focus*, **43**(1), 18-21 (2023).
- [5] \*I. Byrne, N. Dodson, R. Lynch, E.J. Pabon-Cancel and F. Piñero-Gonzalez.  
Improving the minimum distance bound of Trace Goppa codes. *Designs, Codes and Cryptography*. **91**, 2649–2663 (2023).

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## Teaching and Grading Experience

- MA 59500MB: Mathematical Biology (Grading) January 2026–May 2026
- MA 32500: History of Mathematics (Grading) January 2026–May 2026
- MA 26100 REC: Multivariate Calculus Recitation (Teaching) August 2025–December 2025  
January 2025–May 2025  
August 2024–December 2024
- MA 13900: Mathematics for Elementary Teachers III (Grading) June 2024–August 2024

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## Poster Sessions, Presentations and Conferences

- URA-Sandia Graduate Summer Fellowship Lightning Talk (*Virtual*)  
Presentation: Data-Driven Closure Models (DDCMs) 6 August 2025
- Sandia National Laboratories CA SIP Intern Symposium  
*Auditorium, Sandia National Laboratories-Livermore*  
Poster: Data-Driven Closure Models (DDCMs) 5 August 2025  
Livermore, California

- Combinatorics and Coding Theory in the Tropics (UPR-Ponce)  
*Invited REU Seminar: My Story & Permutation-Invariant Parking Assortments*  
18 July 2025  
Virtual Seminar
- Purdue University Student Commutative Algebra Seminar  
*Helen B. Schleman Hall, Purdue University*  
 Presentation: Results in  $\tau_{(n)}$ -factorizations and  $\tau_{(n)}$ -primes.  
18 November 2024  
West Lafayette, Indiana
- Purdue University Student Math History Seminar  
*Lawson Computer Science Building, Purdue University*  
 Presentation: Testimonios: Stories of Latinos and Hispanics in Mathematics  
9 September 2024  
West Lafayette, Indiana
- Underrepresented Students in Topology and Algebra Research Symposium 2024  
*University of Iowa*  
20-21 April 2024  
Iowa City, Iowa
- 2023 MIT Lincoln Lab Intern Innovative Idea Challenge  
*MIT Lincoln Laboratory Auditorium*  
 Poster: Skin-Absorptive and Skin-Growth Boosting Bandages  
 Presentation: SKINS: Skin-growth boosting and Intra-absorptive Solution Bandages  
14, 21 July 2023  
Lexington, Massachusetts
- Combinatorics and Coding Theory in the Tropics (UPR-Ponce)  
*Invited REU Seminar Talk: Graduate School: Application tips and advice*  
7 July 2023  
Virtual Seminar
- 2023 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting  
*University of Puerto Rico at Bayamón, Sponsored by PR-LSAMP*  
 Presentation: Properties of  $\tau_{(n)}$ -primes  
29 April 2023  
Bayamón, Puerto Rico
- 38th Interuniversity Mathematical Sciences Research Seminar  
*University of Puerto Rico, Mayagüez Campus*  
 Presentation: Permutation Invariant Parking Assortments  
24-25 February 2023  
Mayagüez, Puerto Rico
- 2023 AAAS Emerging Researchers National Conference in STEM  
*Omni Shoreham Hotel*  
 Poster: Permutation Invariant Parking Functions with cars of assorted lengths  
9-11 February 2023  
Washington, District of Columbia
- Joint Mathematics Meetings 2023  
*John B. Hynes Veterans Memorial Convention Center*  
 Poster: Permutation Invariant Parking Functions with cars of assorted lengths  
 Presentation: Permutation Invariant Parking Functions with Cars of Arbitrary Lengths  
4-7 January 2023  
Boston, Massachusetts
- Field of Dreams Conference 2022  
*The Graduate Hotel, University of Minnesota-Twin Cities*  
4-6 November 2022  
Minneapolis, Minnesota
- 2022 SACNAS National Diversity in STEM Conference  
*Pedro Roselló Convention Center*  
 Poster: The Study of  $\tau_{(n)}$ -primes  
27-29 October 2022  
San Juan, Puerto Rico
- 2022 Gulf Coast Undergraduate Research Symposium  
*William Marsh Rice University*  
 Presentation: Properties of  $\tau_{(n)}$ -primes  
8-9 October 2022  
Houston, Texas
- Summer@ICERM 2022: Computational Combinatorics  
*Institute for Computational and Experimental Research in Mathematics*  
 Presentation: On Permutation-Invariant Parking Sequences  
3 August 2023  
Providence, Rhode Island
- 2022 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting  
*University of Puerto Rico at Humacao, Sponsored by PR-LSAMP*  
 Presentation: The Study of  $\tau_{(n)}$ -primes  
9 April 2022  
Humacao, Puerto Rico
- Joint Mathematics Meetings 2022 (*Virtual*)  
 Poster: Improving Bounds of Hermitian-Lifted Codes  
6-9 April 2022

- 37th Interuniversity Mathematical Sciences Research Seminar (*Virtual*)  
Poster: The Study of  $\tau_{(n)}$ -primes  
Presentation: Improving Bounds of Hermitian-Lifted Codes
- 2021 Math REU Conference@Clemson University (*Virtual*)  
Presentation: Improved Hermitian-Lifted Codes
- 2021 ACS Junior Technical Meeting-Puerto Rico Interdisciplinary Scientific Meeting (*Virtual*)  
*Sponsored by PR-LSAMP*  
Presentation: The Study of  $\tau_{(n)}$ -atoms
- 35th Interuniversity Mathematical Sciences Research Seminar  
*University of Puerto Rico at Cayey*  
Poster: The Study of  $\tau_{(n)}$ -atoms

25-26 February 2022

19 July 2021

23-24 April 2021

6-7 March 2020  
Cayey, Puerto Rico

## Academics and Graduate Coursework

### Purdue University

#### Qualifying Exams:

MA 55300: Introduction to Abstract Algebra – Passed August 2024 | Grade: A

MA 54400: Real Analysis and Measure Theory – Passed January 2026 | Grade: B

#### Coursework:

MA 61500: Numerical Methods for Partial Differential Equations

January 2026–May 2026

MA 55400: Linear Algebra

August 2025–December 2025

MA 51900: Introduction to Probability

August 2025–December 2025

MA 57300: Numerical Solutions of Ordinary Differential Equations

August 2025–December 2025

MA 59500OT: Computational Optimal Transport and Deep Generative Models

January 2025–May 2025

MA 59800: Topics in Dynamical Systems: Bifurcation Theory

January 2025–May 2025

MA 54600: Introduction to Functional Analysis

January 2025–May 2025

MA 59500AFF: Analytic Theory of Function Fields

August 2024–December 2024

MA 59500MM: Introduction to Mathematical Modeling

August 2024–December 2024

MA 54300: Introduction to Ordinary Differential Equations and Dynamical Systems

January 2024–May 2024

MA 54400: Real Analysis and Measure Theory

January 2024–May 2024

MA 55300: Introduction to Abstract Algebra

August 2023–December 2023

MA 53000: Functions of a Complex Variable I

August 2023–December 2023

### University of Puerto Rico, Mayagüez Campus

MATE 6101: Number Theory I

August 2022–December 2022

MATE 5150: Linear Algebra

January 2021–May 2021

## Student Associations

### PythagoRUM

#### Co-founder & Vice-President

- Served as co-founder and Vice-President for the mathematics and computer science student association. This association has the purpose to promote research in mathematics, as well as related fields of STEM, through professional development workshops and research colloquia.
- Coordinated professional development workshops and semester activities.

**Mayagüez, PR**

August 2022–December 2022

### Society of Physics Students, UPRM Chapter

**Mayagüez, PR**

#### Committee Assistant

August 2018–December 2022

- Served as a Demonstration Committee assistant in 2 physics phenomena presentations. The presentations were for an audience of 20+ elementary school students to motivate them to study science. Served as a Sales Committee assistant in chapter food sales events.