

Raymond Joseph Gabriel Tana

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Education

Penn State University Graduate School

Aug. 2019-Present

- Intended PhD in Mathematics, focusing on Logic, Theoretical Computer Science, and Algorithmic Information Theory.
- GPA: 3.95 (presently)

Schreyer Honors College at Penn State University

Aug. 2015-May 2019

- Honors Bachelor of Science in Mathematics, Bachelor of Science in Physics.
- Honors Thesis on a Computational Approach to Symplectic Billiards.
- GPA: 3.91

Awards/Scholarships

- Charles H. Hoover Memorial Award – Department of Mathematics for Teaching 2024
- Foreign Language and Area Studies Fellowship in Portuguese 2024
- Teaching Associate Status 2023
- John Roe Sustainability Impact Award 2023
- U.S. Foreign Language and Area Studies (FLAS) Fellowship 2023
- Second Place Poster in Eberly Sustainability Expo 2023
- Student Leader Scholarship 2022
- Robert and Betsy Wilson Endowed Scholarship – Department of Mathematics for Teaching 2021
- Student Leader Scholarship 2021
- Student Leader Scholarship 2020
- Student Leader Scholarship 2018
- John & Elizabeth Holmes Teas Scholarship in Science 2018
- Boyd A. and Bernice K. Mullen Awards in Mathematics 2018
- Academic Excellence Scholar Scholarship 2018
- Elsbach Honors Scholarship in Physics 2017
- Best Projects in Algebra, MASS 2017
- Lewis C. Cowley Scholarship 2017
- Best Project Presentation in Algebra 2016
- Best Performance Overall from MASS Program 2016
- Graduation with Distinction from MASS Program 2016
- Lewis C. Cowley Scholarship 2016
- Lewis C. Cowley Scholarship 2015

Mathematical Presentations and Reports

AMS 2025 Eastern Sectional Meeting – Special Session in Computability Theory

Apr. 2025

- *Algorithmic Information Theory on Net Spaces.*
Advisor: Dr. Jan Reimann.

Graduate Student Probability Conference at University of Wisconsin – Madison

Sep. 2024

- *The Role of Semimeasures in Connecting Algorithmic Information Theory and Geometric Measure Theory.* Advisor: Dr. Jan Reimann.

Mathematics Club at Penn State

Mar. 2024

- *Unpacking Compression.*

Logic Student Seminar at University of Pennsylvania

Feb. 2024

- *Dimension Spectrum Conjecture and Finitization;* Advisor: Dr. Jan Reimann.

Logic Seminar at Penn State

Feb. 2024

- *Semimeasure Formalization of Algorithmic Information Theory;* Advisor: Dr. Jan Reimann.

Logic Student Seminar at Penn State

Oct. 2023

- *Hyperarithmetic Sets and Definability, $\Delta_1^1 = HYP$;* Advisor: Dr. Linda Westrick.

Logic Student Seminar at Penn State

Apr. 2023

- *Infinite Computable Monty Hall Problem;* Advisor: Dr. Linda Westrick.

Logic Student Seminar at Penn State

Mar. 2023

- *Guessing Principles and Jensen's Diamond Sequences;* Advisor: Dr. Linda Westrick.

Logic Student Seminar at Penn State	Feb. 2023
- <i>Dimension Spectrum Conjecture and Finitization</i> ; Advisor: Dr. Linda Westrick.	
Logic Seminar at Penn State	Jan. 2023
- <i>Kolmogorov Complexity and Effective Hausdorff Dimension</i> ; Advisor: Dr. Linda Westrick.	
Logic Seminar at Penn State	Nov. 2022
- <i>Degree Spectra within Computable Structure Theory Part II</i> ; Advisor: Dr. Jan Reimann.	
Logic Seminar at Penn State Presentation	Nov. 2022
- <i>Degree Spectra within Computable Structure Theory Part I</i> ; Advisor: Dr. Jan Reimann.	
Comprehensive Oral Exam	Apr. 2022
- <i>Effective Hausdorff Dimension Spectrum & Marstrand's Projection Theorem</i> ; Advisor: Dr. Linda Westrick.	
Quantum Computational Theory Graduate	Dec. 2021
- <i>Perfect Embezzlement of Infinite Entanglement for Nonlocal Games using C^*-algebras</i> ; Advisor: Dr. Chunhao Wang.	
Logic Seminar at Penn State	Oct. 2021
- <i>Effective Hausdorff Dimension and Point to Set Principles</i> ; Advisor: Dr. Jan Reimann.	
Logic Seminar at Penn State	Sep. 2021
- <i>Kolmogorov Complexity and Information Theory</i> ; Advisor: Dr. Jan Reimann.	
C.H. Robinson Data Science Division	July 2021
- <i>Long-term Predicting Trucking Cost</i> ; Advisor: Dr. Kaisa Taipale. IMA Boot Camp VI.	
Quantum Information and Computation Club at Penn State	May 2021
- <i>Introduction to Quantum Computation.</i>	
Logic Seminar at Penn State	Feb. 2021
- <i>Robust Rigidity of the CHSH Game</i> ; Advisor: Dr. Linda Westrick.	
Logic Seminar at Penn State	Nov. 2020
- <i>Applications of the Quantum Fourier Transform</i> ; Advisor: Dr. Linda Westrick.	
Undergraduate Honors Thesis	May 2019
- <i>Computational Approach to Symplectic Billiards</i> ; Advisor: Sergei Tabachnikov.	
Introduction to Quantum Mechanics II Research Report	Dec. 2018
- <i>A Universe without Doppelgängers</i> ; Advisor: Dr. Sarah Shandera.	
MASS Program 2017 [Mathematical Advanced Study Semester]	Dec. 2017
- <i>Edwards Coordinates</i> ; Advisor: Dr. Yuriy Zarkhin.	
Mathematical Outing for Undergraduates at Penn State	Apr. 2017
- <i>Moduli Spaces and $SL(2, \mathbb{R})$ Actions</i> ; Advisor: Dr. Zihren Wang. Group presentation to other math majors on the theory of moduli spaces and actions under $SL(2, \mathbb{R})$.	
MASS Program 2016 [Mathematical Advanced Study Semester]	Dec. 2016
- <i>Geometric and Arithmetic Coding and Geodesics on the Modular Surface</i> ; Advisor: Dr. Federico Rodriguez Hertz.	
- <i>Classification of Quaternion Algebras over \mathbb{Q}</i> ; Advisor: Dr. Svetlana Katok.	
- <i>Weierstrass and Müntz Theorems</i> ; Advisor: Dr. Ludmil Zikatanov.	
Discrete Mathematics Report	Dec. 2015
- <i>Generalized Fermat Numbers</i> ; Advisor: Dr. Svetlana Katok. Generalized the properties of Fermat numbers to other sequences.	
Other Presentations and Reports	
Final Presentation for Intern Project at ASML	Aug. 2024
- <i>Dynamic Reliability Growth Analysis: a new Software Tool</i> ; Advisor: Dr. David Chang.	
FLAS Scholar Summer in Brazil Final Report	Jul. 2023
- <i>A Etnomatemática Aplicada aos Povos Indígenas do Brasil</i> ; Advisor: Luiz Filipe Correia.	
2023 Eberly College of Science Sustainability Expo Graduate Poster Competition	Apr. 2023
- <i>ECoS CY2019 Greenhouse Gas Inventory and its Outcomes</i> ; Advisor: Dr. Charles Anderson.	
2023 Penn State Sustainability Summit	Apr. 2023
- <i>The State of Sustainability Education</i> ; Advisor: Russ deForest.	
2023 Pennsylvania Regional Math Alliance Conference	Feb. 2023
- <i>My Journey to Graduate School</i> ; Advisor: Dr. Jan Reimann.	

JMM Lightning Talks in Environmental Mathematics	Jan. 2023
- <i>Advocacy with Data</i> ; Advisor: Dr. Charles Anderson.	
JMM Workshop on Mathematics for Sustainability	Jan. 2023
- <i>Quantitative and Ethical Reasoning in General Education Mathematics</i> ; Advisor: Russ deForest.	
SPAN 215: Introduction to Spanish Linguistics	Nov. 2022
- <i>Proyecto de Análisis Lingüístico de la Variedad Española de Puerto Rico.</i>	
Penn State University Office of the President Presentation	Apr. 2022
- <i>SSAC Final Presentation Spring 2022</i> ; Advisor: Robert Cooper.	
Council of Commonwealth Student Governments Report	Mar. 2022
- <i>Lifetime CCSG Greenhouse Gas Inventory.</i>	
Penn State University Office of the President Presentation	Nov. 2021
- <i>SSAC Final Presentation Fall 2021</i> ; Advisor: Robert Cooper.	
Eberly College of Science Executive Council	June 2021
- <i>ECoS CY2019 Greenhouse Gas Inventory</i> ; Advisor: Dr. Charles Anderson.	
Penn State University Office of the President Presentation	May 2021
- <i>SSAC Final Presentation Spring 2021</i> ; Advisor: Robert Cooper.	
Eberly College of Science Sustainability Council Town Hall Presentation	Mar. 2021
- <i>Sustainability in Mathematics Education</i> ; Advisor: Russ deForest.	
Penn State University Office of the President Presentation	Nov. 2020
- <i>SSAC Final Presentation Fall 2020</i> ; Advisor: Robert Cooper.	

Teaching Experience

Mathematics Graduate Teaching Assistantship at Penn State	Jan. 2020-Present
- MATH 033 (<i>Mathematics for Sustainability</i>): primary instructor across five semesters and nine sections, creating content on case studies, discussions, writing projects. We prepare students to tackle mathematical and ethical problems in sustainability.	
- MATH 230 (<i>Calculus and Vector Analysis</i>): primary instructor for one semester, created exam and review materials, contributed to course coordination meetings, extended accessibility of course content.	
- MATH 486 (<i>Mathematical Theory of Games</i>): primary instructor for two semesters and in-class teaching assistant across three semesters, lead review sessions and office hours, and ran computational simulations for assignments.	
- MATH 033 (<i>Mathematics for Sustainability</i>): as a mentee for one semester, facilitated group work and class discussions, and lectured a couple of times.	
ESL Instructor through the Mid-State Literacy Council	Jan. 2022-Present
- Instructor of five semesters for Basic English for Spanish Speakers.	
- Design lessons in both Spanish and English relevant to working adults and university-level students.	
- Help students navigate the conversations involved with personal matters such as obtaining health insurance and preparing for university.	

Research Experience

Auburn University REU in Mathematics	June-July 2018
- Generalized “achievement sets” to groups, solving an open question.	
- Constructed counterexamples to existing conjectures for simple, oriented graphs.	
- Presented findings at the Clemson University REU Conference.	
MASS Program at Penn State [Mathematical Advanced Study Semester]	Fall 2016, Fall 2017
- Presented four research projects over two separate semesters.	
- Received Best Project in Algebra in both 2016 and 2017.	

Work and Academic Experience

The Erdős Institute Data Science Teaching Assistant	Jan.-Apr. 2025
- Lead weekly problem-solving sessions for cohorts of 3-5 PhD students, with hands-on guidance in Python, modeling, and ML.	

- Improve overall cohort performance through collaborative learning and best practices, as evidenced by positive student feedback.

The Erdős Institute Fall 2024

Aug.-Dec. 2024

- Enrolled in Data Science Boot Camp, Software Engineering for Data Scientists, and Job Help programs.

ASML Reliability Engineering & UX Engineering Internship

May-Aug. 2024

- Authored software to perform a new, dynamic reliability growth analysis of failure data of various components found in the lithography machines at ASML.
- Developed and disseminated more sophisticated models for anticipating component failure trends over time and for estimating the parameters for such models.
- Advised various projects in their use of Information Theoretic methods and AI to predict failures in individual components found in the lithography machines.

BlueDot Impact AI Safety Fundamentals: Alignment Bootcamp

Mar.-June 2024

- For my final project, I demonstrated empirically how modern large language models can only perform inference so proficiently due to their ability to losslessly compress quite well, suggesting some near-term safety implications with AIXI.
- Curriculum covered Machine Learning, General Intelligence, Reward Specification, Convergence, Goal Generalization, Task Decomposition, Adversarial Techniques, Interpretability, Governance, and Agent Foundations.

Developer for “Calculus with Jupyter”

Jan. 2021.-Aug 2023

- Designed a Jupyter Book and Notebook experience for alternative, accessible, and open-source mathematics education at the collegiate level.
- Introduced accessible ChatGPT assistant to Jupyter notebook experience.
- Specialized in content creation, IPython cell magics, error handling, & text parsing.
- Pursued improved accessibility of educational materials through a universal scripting language suitable for various platforms.
- Implemented a sophisticated machine learning model for automated long descriptions of graphs found in calculus textbooks.

Computability & Combinatorics Workshop at the University of Connecticut

May 2023

- Explored the intersection of combinatorics and computability theory and logic, including three tutorials on the complexity of Ramsey theorems, model-theoretic constructions of random combinatorial structures, and constructive solutions to combinatorial problems.

MSRI Mathematics of Machine Learning Summer School at the Courant Institute

July-Aug. 2022

- Studied five main pillars of theoretical machine learning: convex optimization, online learning, deep learning, statistical learning, and reinforcement learning.
- Collaborated with other mathematics graduate students to solve problem sets and establish opportunities for further investigations beyond the program.

IMS Logic Summer School at the National University of Singapore

July 2022

- Studied continuous logics, tracial von Neumann algebras, quantum complexity theory, gauge theory, Kolmogorov complexity theory, and forcing axioms.
- Collaborated with other logic graduate students to solve exercises, establishing relationships for working beyond the program.
- Reinforced my awareness of the forefront of logic research.

IMA Math-to-Industry Boot Camp VI

June-July 2021

- Rigorously studied Statistical Modelling, Optimization, Machine Learning.
- Designed a new approach to price modelling at C.H. Robinson for its surface transit division within a team of six other PhD students via Neural Networks & Clustering.
- Presented findings in regular check-ins and to C.H. Robinson's Data Science division.

Trace Technologies

Feb.-Aug. 2021

- Placed in the final round of the Nittany AI Competition 2021 by collaborating with four other students to produce a proposal, prototype, marketing video, and MVP.
- Promoted, documented, and steered the group within the competition.
- Implemented ML models on large-scale geophysical data to predict human activity across a geographical area.

Stellar AI

Jan.-July 2022

- Placed in the final round of the Nittany AI Competition 2022.
- Advised a team of 15+ graduate and undergraduate students to produce a minimum viable product with proper documentation, user experience, and market analysis.
- Implemented AI solutions to make searching for, applying to, or posting jobs easier.

Eberly College of Science Sustainability Council Graduate Chair

Oct. 2019-Present

- Performed the college's first greenhouse gas inventory, collaborating with multiple offices and stakeholders to lay an efficient roadmap towards decarbonization.
- Identified syllabi in which sustainability could be further incorporated.
- Facilitated a sustainability town hall and drawdown discussion for the college.
- Advocate for better transportation and carbon reductions strategies.

CET Summer in Brazil through Tulane University

June-July 2023

- Funded by the US Department of Education through a FLAS Scholarship to study the Portuguese language and Brazilian Contemporary Social Issues at the China Educational Tours Center in São Paulo, Brazil for six weeks.
- Researched the ethnomathematics of various indigenous communities within Brazil and the future of Brazilian mathematical education.
- Received top grades in both courses, both taught in Portuguese.

Technical Skills

- Programming Languages
 - o Actively Using: Python, JavaScript, R, HTML.
 - o Good Previous Knowledge: Mathematica, C++, Java, Vue.js, Node.js, MATLAB.
 - o Fair Previous Knowledge: Qiskit, Lua, UNIX.
- Technologies
 - o Actively Using: LaTeX, Markdown, Jupyter, VS Code, GitHub, Microsoft Office, Google Suite, Macintosh, Windows.
 - o Good Previous Knowledge: SQL, PyTorch, TensorFlow, Linux.

Language Skills

- Native speaker of English.
- Advanced in Spanish (C1) and proficient in Portuguese (B2).

Leadership

Officer of Penn State Quantum Information & Computation Club

Mar. 2020-May 2023

- Prepare and deliver lecture content for educational meetings.
- Plan for workshops and guest speaker events.
- Spearhead efforts to expand access and knowledge of Qiskit.

Student Sustainability Advisory Council Working Group Leader

Aug. 2020-May 2023

- Advise university administration on carbon drawdown, divestment, carbon offsets, zero-waste, and sustainability-related outreach and educational experiences.
- Advocate for improved campus navigability and safety for non-drivers.

President and Secretary of Penn State Club Cross Country

Nov. 2016-Nov. 2018

- Communicated with and lead the largest club sport at Penn State.
- Organized multiple highly-respected invitationals hosting over 1,000 athletes.
- Represented the club to the national running league and university administration.

Vice President and Treasurer of Penn State Math Club

Apr. 2016-Apr. 2018

- Established records of past finances and future budgets.
- Organized a weekly lecture series primarily with Penn State faculty members.
- Created and presented competition and lecture material for the club.

Community Service

Mid-State Literacy Council

Jan. 2022-Present

- Instructor of Basic English for Spanish Speakers to local community members.

Prison Mathematics Project

Jan. 2023-Present

- Correspond with incarcerated individuals as their pen-pal and mathematical mentor.
- Provide research-track mathematical problems and solutions to help prisoners with low access to educational and technological resources to develop their skills in research and practical mathematics.

Penn State Club Cross Country Benefiting THON

Aug. 2015-Present

- Facilitated the largest alternative fundraiser in THON history: Miles for Smiles.
- Danced for 46 hours straight in THON 2019, helping the club raise \$67,400.
- To date have assisted in raising \$370,000 for the Four Diamonds Fund.

Bike Tour de PA for CHILD USA

Jul.-Aug. 2019

- Completed a two week, 800-mile, solo bike tour around Pennsylvania benefiting CHILD USA, raising a few thousand dollars.
- Met with CHILD USA representatives to encourage specific policies be proposed.
- Featured on news to raise awareness of CHILD USA's mission against child abuse.

Other Volunteer Work

- Worked in soup kitchen in Cutillo's Restaurant serving a local homeless shelter.
- Mutual aid by providing food to the community: State College and San Francisco.

Jun.-Aug. 2020
May 2020-Present