

Daniel Perales Anaya

POSTDOCTORAL RESEARCH ASSOCIATE · MATHEMATICS

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Education

University of Waterloo

Waterloo, ON, Canada

PHD IN PURE MATHEMATICS

2018 - 2022

- Thesis: Brands of cumulants in non-commutative probability, and relations between them.
- Advisor: Dr. Alexandru Nica

Centro de Investigación en Matemáticas (CIMAT)

Guanajuato, Mexico

MASTER OF SCIENCE (PROBABILITY AND STATISTICS)

2016 - 2018

Thesis: Interlacing families of polynomials (in Spanish), supervised by Dr. Octavio Arizmendi.

Universidad Nacional Autónoma de México (UNAM)

Mexico City, Mexico

BACHELOR IN PURE MATHEMATICS (WITH HONORS)

2011 - 2016

Thesis: Cumulants in Finite Free Probability (in Spanish), supervised by Dr. Octavio Arizmendi.

Research

Research interests: Finite Free Probability (a combination of free probability, roots of polynomials and random matrices), relations between non-commutative cumulants, infinitesimal freeness, and anti-commutator.

PUBLICATIONS (For links check my [webpage](#))

- [14] A. Martínez-Finkelshtein, R. Morales, D. Perales. Zeros of orthogonal little q -Jacobi polynomials: interlacing and monotonicity. *Preprint* arXiv:2506.05492.
- [13] O. Arizmendi, D. Perales, J. Vazquez-Becerra. Finite Free Convolution: Infinitesimal Distributions. *Preprint* arXiv:2505.01705.
- [12] J. Campbell, R. Morales, D. Perales. Even Hypergeometric Polynomials and Finite Free Commutators. *Preprint* arXiv:2502.00254.
- [11] O. Arizmendi, K. Fujie, D. Perales, Y. Ueda. S -transform in Finite Free Probability. *Preprint* arXiv:2408.09337.
- [10] A. Martínez-Finkelshtein, R. Morales, D. Perales. Zeros of generalized hypergeometric polynomials via finite free convolution. Applications to multiple orthogonality. *Constructive Approximation*, 2025.
- [9] A. Martínez-Finkelshtein, R. Morales, D. Perales. Real roots of hypergeometric polynomials via finite free convolution. *International Mathematics Research Notices, Volume 2024, Issue 16, Pages 11642–11687*, 2024.
- [8] O. Arizmendi, J. Garza-Vargas, D. Perales. Finite Free Cumulants: Multiplicative Convolutions, Genus Expansion and Infinitesimal Distributions. *Transactions of the American Mathematical Society*, 376, 06: 4383–4420, 2023
- [7] A. Celestino, K. Ebrahimi-Fard, A. Nica, D. Perales, L. Witzman. Multiplicative and semi-multiplicative functions on non-crossing partitions, and relations to cumulants. *Advances in Applied Mathematics*, 145, 102481, 2023.
- [6] D. Perales. On the anti-commutator of two free random variables. *Indiana University Mathematics Journal*, 72:1867–1908, 2023.
- [5] D. Perales, P.L. Tseng. On operator-valued infinitesimal Boolean and monotone independence. *Infinite Dimensional Analysis, Quantum Probability and Related Topics*, vol 24(03), Article No. 2150019, 2021.
- [4] A. Celestino, K. Ebrahimi-Fard, F. Patras, D. Perales. Cumulant-cumulant relations in free probability theory from Magnus' expansion. *Foundations of Computational Mathematics*, DOI: 10.1007/s10208-021-09512-0, 2021.
- [3] A. Celestino, K. Ebrahimi-Fard, D. Perales. Relations between infinitesimal non-commutative cumulants. *Documenta Mathematica* 26:1145–1185, 2021.

- [2] O. Arizmendi, D. Perales. A Berry–Esseen Type Theorem for Finite Free Convolution. *In XIII Symposium on Probability and Stochastic Processes. Progress in Probability*, vol 75, p 67-76. *Birkhäuser, Cham*, 2020.
- [1] O. Arizmendi, D. Perales. Cumulants for finite free convolution. *Journal of Combinatorial Theory, Series A*, 155:244-266, 2018.

INVITED TALKS

Jun 2025	36. Free Probability, Random Matrices and Finite-Dimensional Approx , CMO, 60min	Oax, Mex
Apr 2025	35. Brazos Analysis Seminar , Baylor University, 45min	Waco, TX
Apr 2025	34. Duke Probability Seminar , 50min	Durham, NC
Apr 2025	33. Analysis Seminar , University of Houston	Houston, TX
Apr 2025	32. Free Probability and Operators Seminar , Texas A&M	College S., TX
Feb 2025	31. Recent Perspectives on Non-crossing Partitions , ESI, 25min	Vienna, Aus
Oct 2024	30. Inter-Institutional Seminar in Random Matrices (SIMA) , UADY, 3hr mini-course	Merida, Mex
Oct 2024	29. SIAM TX-LA, Orthogonal Polynomials and Special Functions , Baylor U, 25min	Texas
Oct 2024	28. Purdue Operator Algebra Seminar , Purdue University, 50min	Indiana
Sep 2024	27. Student Operator Algebras Seminar , Purdue University, 50min	Indiana
Sep 2024	26. Analysis Seminar , University of Houston, 50min	Texas
Sep 2024	25. AMS sec. meet. Noncommutative Geometry and Analysis , UT San Antonio, 25min	Texas
Sep 2024	24. Algebra and Combinatorics Seminar , Texas A&M University, 50min	Texas
Aug 2023	23. Free Probability and Operators Seminar , Texas A&M University, 50min	Texas
Aug 2024	22. Probabilistic Operator Algebra Seminar , UC Berkeley, 70min	online
Aug 2024	21. Random Matrices and Free Probability in IWOTA , University of Kent, 25min	Canterbury
Aug 2024	20. Orthogonal Polynomials and Special Functions in IWOTA , University of Kent, 25min	Canterbury
Apr 2024	19. Seminar in Operator Theory and Operator Algebras , University of Virginia, 50min	Virginia
Apr 2024	18. Random Matrices and Free Probability Theory , MAA Rocky Mountain Section, 20min	Cololorado
Jan 2024	17. Probability Seminar , Warsaw University of Technology, 90min	online
Jan 2024	16. Quantum Information Theory and Free Probability , NYU Abu Dhabi, 40min	Abu Dhabi
Nov 2023	15. Probabilistic Operator Algebra Seminar , UC Berkeley, 70min	online
Oct 2023	14. Seminario de Probabilidad , CIMAT Mexico, 50min	Guanajuato
Jun 2023	13. Free Probability Theory and Random Matrices , Hokkaido U. of Education, 50min	Asahikawa
Feb 2023	12. Baylor Analysis Seminar , Baylor University, 50min	Texas
Feb 2023	11. Random Matrices and Free Probability Learning Seminar , Baylor University, 50min	Texas
Oct 2022	10. Free Probability and Operators Seminar , Texas A&M University, 3 talks, 50min	Texas
Jun 2022	9. Free Probility, Random Matrices, and Applications , U of Wyoming, 30min	Laramie
May 2022	8. Algebra and Combinatorics Seminar , Texas A&M University, 50min	Texas
Feb 2022	7. Seminar on Free Probability and Random Matrices , Queen’s University, 50min	online
Oct 2021	6. Probabilistic Operator Algebra Seminar , UC Berkeley, 50min	online
Jul 2021	5. Analysis Student Seminar , University of Waterloo, 50min	online
Apr 2021	4. Probability Seminar , Warsaw University of Technology, 90min	online
Apr 2021	3. Analysis Seminar , University of Wyoming, 50min	online
Sep 2020	2. Pure Math Grad Colloquium , University of Waterloo, 50min	online
Sep 2020	1. Seminar on Free Probability and Random Matrices , Queen’s University, 90min	Kingston

POSTER PRESENTATIONS AND SHORT TALKS

Oct 2024	Postdoc lunch talks, Texas A&M University, 20min	Texas
Aug 2024	Young Mathematicians in C^* -Algebras, University of Glasgow, 3min	Glasgow
Aug 2023	Young Mathematicians in C^* -Algebras, KU Leuven, 3min	Leuven
Jun 2023	Poster at Random Matrices and Applications, RIMS	Kyoto
Nov 2021	Discussant at Topological Recursion and Combinatorics mini-workshop, 15min	online
May 2021	Talk at Seminario de Probabilidad Hispanohablante, in Spanish, 10min	online
Nov 2017	Poster at Inter-Institutional Seminar in Random Matrices (SIMA), CIMAT Mexico	Guanajuato
Mar 2017	Poster at CIMAT-UA Workshop, University of Arizona	Arizona

OTHER RESEARCH ACTIVITIES

Sep 2024	2-day visit, to collaborate with P. Zhong, University of Houston	TX, USA
Apr 2024	4-day visit, to give a talk and collaborate with J. Campbell, University of Virginia	VA, USA
Mar 2024	1-day visit, to collaborate with A. Martínez-Finkelshtein and R. Morales, Baylor University	Waco, TX, USA
Dec 2023	3-day visit, to collaborate with A. Martínez-Finkelshtein and R. Morales, Baylor University	Waco, TX, USA
Oct 2023	8-day visit, to give a talk and collaborate with O. Arizmendi, CIMAT	Gto, Mex
Aug 2023	2-day visit, to collaborate with Z. Kabluchko, Munster University	Munster, Ger
Aug 2023	3-day visit, to collaborate with A. Celestino, TU Graz	Graz, Aus
Jun 2023	10-day visit, to collaborate with K. Fujie and Y. Ueda, Hokkaido University of Education	Asahikawa, JP
Jun 2023	2-day visit, to collaborate with N. Sakuma, Nagoya University	Nagoya, JP
Feb 2023	3-day visit, to give 2 talks and collaborate with A. Martinez-Finkelshtein, Baylor University	Waco, TX, USA
Mar 2020	3-day visit, to give a talk and collaborate with P.L. Tseng, Queen's University	Kingston, Can
Nov 2019	1-week visit, to work with K. Ebrahimi-Fard and A. Celestino. NTNU, Trondheim	Trondheim, Nor
Jun 2019	3-week workshop, Focus Program on Applications of Non-comm. Functions, Fields Inst.	Toronto, Can
Mar 2019	1-month workshop, New Developments in Free Probability and Applications, CRM	Montreal, Can
Apr 2018	1-week workshop, Expected Characteristic Polynomial Techniques and Applications, UCLA	LA, USA
Jan 2016	2-month Summer School, Institute for Pure and Applied Mathematics (IMPA), Brazil	Rio de Jan, BR

Teaching

INSTRUCTOR

Spr 2025	Analysis on the Real Line, fourth year course	Texas A&M U
Fall 2024	Measure Theory and Probability Theory, honor directed studies	Texas A&M U
Fall 2024	Linear algebra, third year course, 2 sections	Texas A&M U
Spr 2024	Introduction to probability, fourth year course	Texas A&M U
Fall 2023	Linear algebra and vector calculus, third year course, 2 sections	Texas A&M U
Spr 2023	Linear algebra and vector calculus, third year course	Texas A&M U
Fall 2022	Linear algebra, third year course, 2 sections	Texas A&M U
Win 2022	Elementary Number Theory, third year course	U of Waterloo
Oct 2021	Guest lecture in Calculus 1, for Honours Mathematics	U of Waterloo

MATHEMATICAL OLYMPIAD INSTRUCTOR (OUTREACH)

Since 2012 I have taught more than 500 hours of lectures on basic undergraduate topics. My students range from elementary school up to undergraduate level and have succeeded in national and international Olympiads.

2019–2021	Occasional Instructor at Mexican National camps, for high-school students	Online
2012–2018	Regular Instructor at Mexican National camps, for elementary and high-school students	Mexico
2015–2018	Instructor at Guanajuato State camps, for elementary and high-school students	Gto, Mexico
2012–2015	Instructor at Morelos State camps, for elementary and high-school students	Mor, Mexico

Jul 2019	Mexico-Canada pre-IMO 1-week camp , joint training for IMO teams	ON, Canada
Jun 2018	Introduction to Mathematical Olympiads , for high-school teachers	Zac, Mexico
Jan 2018	Panama National Team 3-week camp , principal lecturer	Panama City
Jul 2017	Mexico-Canada pre-IMO 1-week camp , joint training for IMO teams	Oax, Mexico

TEACHING ASSISTANT

Main duties: marking assignments and exams, running tutorials, and solving students doubts.

I am familiar with the following software: Learn, Canvas, Crowdmark, Gradescope, Möbius and Piazza.

Fall 2021	Algebra (Advanced Level) and Elementary Number Theory ,	U of Waterloo
Spr 2021	Linear Algebra 2 (Advanced Level) and Elementary Number Theory ,	U of Waterloo
Win 2021	Elementary Number Theory ,	U of Waterloo
Fall 2020	Foundations of Calculus I (for Teacher's Master) and Elementary Number Theory ,	U of Waterloo
Spr 2020	Calculus 2 (for Engineering) and Elementary Number Theory ,	U of Waterloo
Win 2020	Elementary Number Theory ,	U of Waterloo
Fall 2019	Calculus 3 (Advanced) and Introduction to Real Analysis ,	U of Waterloo
Spr 2019	Real Analysis ,	U of Waterloo
Win 2019	Applied Complex Analysis ,	U of Waterloo
Fall 2018	Calculus 1 (for Honours Mathematics) and Linear Algebra (for Engineering) ,	U of Waterloo
2017	Stochastic Models I (for Master's degree students) ,	CIMAT
2015	Calculus II (for Honours Mathematics) ,	UNAM
2014	Analytic Geometry II (for Honours Mathematics) ,	UNAM

OTHER TEACHING RELATED ACTIVITIES

Texas A&M High School Mathematics Contest (outreach), helped grading the power team exams on 2023 and 2024.

TAMU Math Circle (outreach), instructor at the discovery session on November 19, 2022. An outreach activity that brings 5th - 12th grade students into direct contact with mathematical professionals in an informal setting to work on fun and interesting topics in mathematics.

Grad Student Instructor Seminar, attended a weekly seminar on how to improve teaching skills focused on math courses. Hosted by Pure Math department at U of Waterloo, Winter 2022. This seminar later evolve into the MATH 900 course.

Translator (from English to Spanish) of the 'problems of the week' from The Centre for Education in Mathematics and Comp at U of Waterloo, designed to provide students with an ongoing opportunity to solve math problems, 2019–2021.

Translator (from English to Spanish) of several contents of the [Khan Academy website](#). A non-profit with the mission to provide a free, world-class education for anyone, anywhere, 2014–2015.

Course for Teachers, attended a 3-day workshop for high school and Mathematics Olympiad teachers on how to improve your teaching in mathematics. January 2012.

Service

Organizer of **Free Probability and Operators Seminar** at Texas A&M University, since Fall 2022.

Co-organizer of **Probability and Algebra: New Expressions In Mathematics**, held at Texas A&M University on July 2023.

Member of the **National Organizing Committee** of the Mexican Mathematical Olympiad, where I helped organize all the Mexican Math Olympiads and camps that take place in Mexico all year long. 2014-2019.

Team leader and deputy leader of the Mexican team in six Mathematical Olympiads: IMO 2018 Romania, CIIM 2017 Ecuador, OIM Argentina 2017, OMCC 2016 Jamaica, EGMO Belarus 2015, OIM 2014 Honduras.

Co-organizer of **State of Guanajuato Olympiad Camps from 2016 to 2018**, helping with scheduling lecturers, students' accommodation, creating exams. I also created a syllabus of the topics in Geometry.

Co-organized of the **2016 and 2017 Western Regional Olympiad** that hosted around 100 students in Guanajuato.

Grants and Awards (selected)

GRANTS

2024-2026 **Travel Grant**, AMS-Simons \$5000

AWARDS

2017 **Honorable Mention at the Sotero Prieto Award**, for best bachelor thesis in mathematics.
Mexican Mathematical Society.

2011–2015 **Medals at College Math Competitions**, 3 silvers at **International (IMC)**, 3 golds, 1 silver, 1
bronze at **Iberoamerican (CIIM)**.

2008–2011 **Medals at Math Olympiads**, 1 silver, 1 bronze at **International (IMO)**, 2 silvers at
Iberoamerican (OIM), 2 silvers at **Asian-Pacific (APMO)**, 3 golds (1 perfect score) at
Mexican National (OMM).

2010 **National Youth Award**, for under 18 with the most outstanding academic activities.
National Youth Institute (Mexico).

2010 **Morelos State Youth Award**, for under 18 with the most outstanding academic activities.
Morelos State Youth Institute.

SCHOLARSHIPS

Win 2022 **Susan and Janos Aczel Graduate Scholarship**, U of Waterloo

2018–2022 **International Graduate Studies Scholarship**, CONACYT (Mexico)

2016–2018 **Graduate Studies Scholarship**, CONACYT (Mexico)

2011–2015 **Scholarship for undergraduate studies**, Telmex Foundation
Scholarship for undergraduate studies, Mexican Academy of Sciences