Carlos A. Agrinsoni Santiago

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Department of Mathematics, Purdue University

EDUCATION

Purdue University 2022 – Present

Ph.D. in Mathematics

- **Relevant Courses:** Geometry, Topology and Algebra of Loop spaces, Commutative Algebra, Algebraic Number Theory, Class Field Theory, Algebraic Geometry I & II, Finite Geometry, Toric Geometry, Lie Algebras, Category Theory, Homological Algebra, Topics in Commutative Algebra.
- **Qualifying Exams:** Approved Abstract Algebra, Linear Algebra, and Real Analysis.
- **Research Area:** Combinatorics, algebraic geometry, and Algebraic Topology.
- **Advisor:** Dr. Manuel Rivera

University of Puerto Rico at Rio Piedras 2017 – 2021

M.S. in Mathematics

- **Qualifying Exams:** Approved Abstract Algebra (with Honors), Real Analysis, and Topology.
- **Research Area:** Number Theory and applications to Cryptography; absolute irreducibility of polynomials; Exceptional Almost Perfect Nonlinear (APN) Conjecture; Network Theory.
- **Advisor:** Dr. Heeralal Janwa

University of Puerto Rico at Cayey 2013 – 2017

B.S. in Mathematics

- **Research Area:** APN Functions as S-boxes for Cryptographic Systems.
- **Advisor:** Dr. Moises Delgado

POSITIONS

Purdue University 2022 – 2026

Andrews Fellow

University of Puerto Rico at Rio Piedras 2017 – 2021

NASA Fellow (2019–2021)

Graduate Teaching Assistant (2017–2019)

University of Puerto Rico at Cayey 2016 – 2017

Mathematics Tutor – Student Support Center

AWARDS AND HONORS

- Andrews Fellowship, Purdue University (2022–2026).
- NASA Puerto Rico Space Grant Fellowship (Grant No. NNX15AI11H & 80NSSC20M0052) (2019–2021).
- PEAF Award (Programa de experiencias académicas formativas) (2017–2019).
- National Science Foundation (NSF) MSRI-UP Grant (DMS-1156499).
- National Security Agency (NSA) MSRI-UP Grant (H98230-116-1-0033).
- NSF Summer Northwestern Analysis Program (1502632).
- NSF & NSA MTBI Grant (Arizona State University).
- MAA Travel Award, Joint Mathematics Meetings (2017).

STUDENT MENTORING

- Alec S. Zabel Mena
- Miguel E. Cruz Molina

PRESENTATIONS

Talks

1. **Agrinsoni-Santiago, C. A.** "A New Criterion for the Absolute Irreducibility of Multivariate Polynomials over Finite Fields and Applications." Purdue Math Student Colloquium. September 2, 2026

2. **Agrinsoni-Santiago, C. A.** "Resolution of the Gold Degree case of the Exceptional APN Conjecture and new Progress in the Kasami-Welch Degree case." Purdue Algebraic Geometry Seminar, April 22, 2026

3. **Agrinsoni-Santiago, C. A.** "Existence of an Absolutely Irreducible Component of the Twisted Kasami–Welch Surface and the Exceptional APN Conjecture." AMS Southeastern Sectional Meeting 2025. October 4, 2025.

4. **Agrinsoni-Santiago, C. A.**, **Zou R.**, "Théorème de Lefschetz et critères de dégénérescence de suites spectrales by Pierre Deligne (Classical Papers/Preprint Seminar)." Algebraic Geometry Seminar, Purdue University. April 3, 2024.

5. **Agrinsoni-Santiago, C. A.** "Some New Results in the Even Case of the Exceptional Almost Perfect Nonlinear Conjecture." SIDIM XXXIX Seminario Interuniversitario de Investigación en Ciencias Matemáticas. March 1, 2024.

6. **Agrinsoni-Santiago, C. A.** "The Exceptional Almost Perfect Nonlinear Function Conjecture." UPRRP Math Seminar, University of Puerto Rico at Rio Piedras. February 29, 2024.

7. **Agrinsoni-Santiago, C. A.** "Resolution of the exceptional APN conjecture for the Gold degree case." SELMER CENTER SEMINARS 2024. February 5, 2024.

8. **Agrinsoni-Santiago, C. A.** "Some New Techniques for the Resolution of the Exceptional Almost Perfect Nonlinear Conjecture." 2024 Joint the Mathematics Meetings, AMS Special Session on Combinatorics for Science, II. January 6, 2024.

9. **Agrinsoni-Santiago, C. A.** "The Exceptional Almost Perfect Nonlinear Function Conjecture." Automorphic Forms and Representation Theory Seminar, Purdue University. April 27, 2023.

10. **Agrinsoni-Santiago, C. A.** "Our Resolution of the Gold Case of the Exceptional Almost Perfect Nonlinear Conjecture." Purdue Math Student Colloquium, Purdue University. March 22, 2023.

11. **Agrinsoni-Santiago, C. A.** "A New Absolute Irreducibility Criterion for Multivariate Polynomials over Finite Fields: Its Complexity and Applications." The Fifty-third Southeastern International Conference on Combinatorics, Graph Theory, and Computing. March 11, 2022.

12. **Agrinsoni-Santiago, C. A.** "Completion of the Conjecture on Exceptional APN Gold and Kasami-Welch Odd Degree Case." 26th International Conference on Applications of Computer Algebra, session: Computer Algebra in Coding Theory and Cryptography. July 23, 2021.

13. **Agrinsoni-Santiago, C. A.** "An Explicit Characterization of Factorization of a Large Class of Multivariate Polynomials in terms of Absolutely Irreducible Factors Over Finite Fields." The Fifty-second Southeastern International Conference on Combinatorics, Graph Theory, and Computing. March 11, 2021.

14. **Agrinsoni-Santiago, C. A.** "Gold degree polynomials with even second highest term with 2-adic value 1 mod 4 are not exceptional APN in the context of the APN function conjecture." SIDIM XXXVI. February 27, 2021.

15. **Agrinsoni-Santiago, C. A.** "Characterization of Factorization of Certain infinite families of Polynomial of Several Variables." SIDIM XXXV. March 7, 2020.

16. **Agrinsoni-Santiago, C. A.** "Algebraic Curves, Exceptional APN Conjecture and Zeta Function of Singular Curves over Finite Fields and Applications to Cryptography and Coding Theory." Seminary University of Puerto Rico at Rio Piedras. May 13, 2019.

17. **Agrinsoni-Santiago, C. A.** "Some Progress on the Conjecture on APN Functions." Seminary University of Puerto Rico at Rio Piedras. December 18, 2018.

18. **Agrinsoni-Santiago, C. A.** "Aplicaciones de Funciones No-lineales casi Perfectas en el Diseño de Sistemas Criptográficos." Cuarto Encuentro Estudiantil de Investigación, University of Puerto Rico at Cayey. July 12, 2017.

19. **Agrinsoni-Santiago, C. A.** "Funciones No lineales y sus Aplicaciones a la Criptografía." Primer Encuentro Estudiantil de Investigación, University of Puerto Rico at Cayey. May 15, 2015.

Posters

1. **Agrinsoni-Santiago, C. A.** "Biomolecular Networks: Novel Advanced Analysis." 39th Annual Meeting for the American Society for Gravitational and Space Research. November 16, 2023.

2. **Agrinsoni-Santiago, C. A.** "Novel Methods and Analysis of Network Sciences and ML for the Gene Regulatory Networks of Mice and Humans for Therapeutics for Diseases from the Effects of Microgravity." 38th ASGSR Meeting. November 10, 2022.

3. **Agrinsoni-Santiago, C. A.** "Gene Regulatory Network Analysis Using Topological and Spectral Methods and Their Efficient Implementations in SAGE and CYTHON." Cellular and Molecular Bioengineering Conference. January 3–6, 2020.

4. **Agrinsoni-Santiago, C. A.** "Gene Regulatory Network Analysis..." NASA Road Tour at UPR-RP. November 13, 2019.

5. **Agrinsoni-Santiago, C. A.** "APN Functions, Cyclic Codes, Exceptional APN Conjecture, and Curves with Many Rational Points." 2019 Conference of Ford Fellows. October 4, 2019.

6. **Agrinsoni-Santiago, C. A.** "Applications of Almost Perfect Nonlinear Functions in the Design of Cryptographic systems." SIDIM XXXII. March 4, 2017.

7. **Agrinsoni-Santiago, C. A.** "Combinatorial and Algebraic Properties of Generalized Crown Graphs." Joint the Mathematical Meetings. January 6, 2017.

8. **Agrinsoni-Santiago, C. A.** "Combinatorial and Algebraic Properties of Generalized Crown Graphs." SACNAS Meeting. October 13, 2016.

9. **Agrinsoni-Santiago, C. A.** "Modeling the Interaction Between Honeybees and Food Availability." Joint the Mathematical Meetings. January 8, 2016.

10. **Agrinsoni-Santiago, C. A.** "How Data Encryption Standard works? Mathematics Awareness Week." University of Puerto Rico at Cayey. April 20–24, 2015.

WORKSHOPS

- SIDIM XXXIV, March 1–2, 2019.
- SIDIM XXXIII, March 22–23, 2018.
- Summer Northwestern Analysis Program 2017, July 24–28, 2017.
- SIDIM XXXII, March 3–4, 2017.
- 2016 Field of Dreams Conference Saint Louis, November 4–6, 2016.
- SIDIM XXXI, March 4–5, 2016.

PUBLICATIONS

1. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (To be submitted). "Some more Functions that are not Exceptional APN in the Kasami-Welch case" *Journal of Algebra*.

2. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (To be submitted). "Some New Results on Absolute Irreducibility of Multivariate Polynomials." *AMS Mathematics of Computation*.

3. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (To be submitted). "Some New Techniques for the Resolution of the Exceptional Almost Perfect Nonlinear Conjecture." *Contemporary Mathematics*.

4. Janwa, H., Velev, J., & **Agrinsoni, C.** (To be submitted). "On the Origin of Biomolecular Networks." *Gravitational and Space Research*.

5. **Agrinsoni, C.**, Zabel-Mena, A. S., & Janwa, H. (Accepted). "Absolute Irreducibility of Generalized Trinomials Defined by APN Functions of the Form $g(x) = x^{2^i e} + h(x)$ over $\mathbb{F}_{2^s}$." *Springer-Verlag Proceedings in Mathematics and Statistics*.

6. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (Accepted). "New Approach to Test Absolute Irreducibility of a Multivariate Polynomial with a Square Leading Form." *Springer-Verlag Proceedings in Mathematics and Statistics*

7. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2026). "A New Criterion for the Absolute Irreducibility of Multivariate Polynomials over Finite Fields." https://doi.org/10.48550/arXiv.2602.01583.

8. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2026). "Classification of Generalized Quadrinomials." *Springer-Verlag Proceedings in Mathematics and Statistics*.

9. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2025). "Progress in the Kasami Welch of the Exceptional APN Conjecture." *Journal of Algebra and its Applications*.

10. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2025). "Resolution of the Exceptional APN Conjecture in the Gold Degree Case." *Designs, Codes and Cryptography*, pp. 1–23.

11. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2024). "A New Absolute Irreducibility Criterion for Multivariate Polynomials over Finite Fields." *Springer-Verlag Proceedings in Mathematics and Statistics*, pp. 1–10.

12. **Agrinsoni, C.**, Janwa, H., & Delgado, M. (2024). "New Absolute Irreducibility Testing Criteria and Factorization of Multivariate Polynomials." *Springer-Verlag Proceedings in Mathematics and Statistics*, pp. 1–10.

13. Delgado, M., Janwa, H., & **Agrinsoni, C.** (2023). "Some New Techniques and Progress Towards the Proof on the Conjecture on Exceptional APN Functions and Absolutely Irreducible Polynomials." *Designs, Codes and Cryptography*, pp. 1–18.

14. Manian, V., Orozco-Sandoval, J., Diaz-Martínez, V., Janwa, H., & **Agrinsoni, C.** (2022). "Detection of Target Genes for Drug Repurposing to Treat Skeletal Muscle Atrophy in Mice Flown in Spaceflight." *Genes*, 13(3), 473.

15. **Agrinsoni, C.** (2022). "Some new absolutely irreducibility testing criteria and their applications to the proof of a conjecture on exceptional almost perfect nonlinear (E-APN) function." (Master Thesis), University of Puerto Rico, Rio Piedras.

16. Manian, V., Gangapuram, H., Orozco, J., Janwa, H., & **Agrinsoni, C.** (2021). "Network Analysis of Local Gene Regulators in Arabidopsis thaliana under Spaceflight Stress." *Computers*, 10(2), 18.

17. Manian, V., Orozco, J., Gangapuram, H., Janwa, H., & **Agrinsoni, C.** (2021). "Network Analysis of Gene Transcriptions of Arabidopsis thaliana in Spaceflight Microgravity." *Genes*, 12(3), 337.

18. **Agrinsoni-Santiago, C. A.**, et al. (2016). "Modeling the Interaction Dynamics between Honeybees and Food Availability." *DEStech Transactions on Computer Science and Engineering*.

19. Delgado, M., Reyes, R., & **Agrinsoni, C.** (2016). "DES-like Ciphers, Differential Attacks and APN Functions." *Journal of Mathematical Sciences: Advances and Applications*.