

Carlos E. Arreche

Curriculum Vitae

- Snail mail: Department of Mathematical Sciences, FO 35 // Richardson, Texas 75080-3021 // United States.
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RESEARCH INTERESTS Differential Algebraic Geometry, Algebraic Theory of Differential and Difference Equations, Galois Theories, Symbolic Computation, and Algebraic Combinatorics.

PROFESSIONAL HISTORY Assistant Professor. Fall 2017–present
Department of Mathematical Sciences,
The University of Texas at Dallas, Richardson, TX.

Postdoctoral Fellow. Fall 2014–Spring 2017
Mathematics Department,
North Carolina State University, Raleigh, NC.
Advisor: Michael F. Singer

Postdoctoral Visitor. Fall 2015
Fields Institute for Research in Mathematical Sciences, Toronto, Canada.

Adjunct Instructor. Fall 2013–Spring 2014
Brooklyn College, City University of New York, Brooklyn, NY.

EDUCATION Ph.D. in Mathematics. 2014
City University of New York (Graduate Center), New York, NY.
Advisor: Alexey Ovchinnikov

M.Phil. in Mathematics. 2012
City University of New York (Graduate Center), New York, NY.

Master of Advanced Study in Pure Mathematics. 2009
University of Cambridge (King's College), Cambridge, UK.

A.B. in Mathematics. (*cum laude*) 2008
Certificate of Proficiency in Latin American Studies
Princeton University (Rockefeller College), Princeton, NJ.

PAPERS

Preprints:

(with [H. Sitaula](#)). *Computing discrete residues of rational functions.* (submitted: 02/2024).
[arXiv:2402.07328](https://arxiv.org/abs/2402.07328)

(with [M. Arnold](#)). *Symmedians as hyperbolic barycenters.* (submitted: 11/2023).
[arXiv:2311.14194](https://arxiv.org/abs/2311.14194)

(with [Y. Zhang](#)) *Twisted Mahler discrete residues.* (submitted: 09/2023).
[arXiv:2308.16765](https://arxiv.org/abs/2308.16765)

Peer-reviewed articles:

(with [N. Williams](#)) *Normal reflection subgroups of complex reflection groups*. Journal of the Institute of Mathematics of Jussieu **22**(2), 879–917, (2023). [doi:10.1017/S1474748021000323](https://doi.org/10.1017/S1474748021000323)

(with [Y. Zhang](#)) *Mahler discrete residues and summability for rational functions*. Proceedings of ISSAC 2022, 525–533, (2022). [doi:10.1145/3476446.3536186](https://doi.org/10.1145/3476446.3536186)

(with [Y. Zhang](#)) *Computing differential Galois groups of second-order linear q -difference equations*. Advances in Applied Mathematics **132**, (2022). [doi:10.1016/j.aam.2021.102273](https://doi.org/10.1016/j.aam.2021.102273)

(with [T. Dreyfus](#) and [J. Roques](#)) *Differential transcendence criteria for second-order linear difference equations and elliptic hypergeometric functions*. Journal de l'École Polytechnique — Mathématiques **8**, 147–168, (2021). [doi:10.5802/jep.143](https://doi.org/10.5802/jep.143)

(with [N. Williams](#)) *Normal reflection subgroups*. Proceedings of FPSAC 2020, Séminaire Lotharingien de Combinatoire **84B** (2020), Article #92, 12pp. [arXiv:2006.06575](https://arxiv.org/abs/2006.06575); [SLC link](#)

(with [M.F. Singer](#)) *Galois groups for integrable and projectively integrable linear difference equations*. Journal of Algebra **480**, 423–449, (2017). [doi:10.1016/j.jalgebra.2017.02.032](https://doi.org/10.1016/j.jalgebra.2017.02.032)

Computation of the difference-differential Galois group and differential relations among solutions for a second-order linear difference equation. Communications in Contemporary Mathematics **19**(6), (2017). [doi:10.1142/S0219199716500565](https://doi.org/10.1142/S0219199716500565)

On the computation of the parameterized differential Galois group for a second-order linear differential equation with differential parameters. Journal of Symbolic Computation **75**, 25–55, (2016). [doi:10.1016/j.jsc.2015.11.006](https://doi.org/10.1016/j.jsc.2015.11.006)

Computing the differential Galois group of a parameterized second-order linear differential equation. Proceedings of ISSAC 2014, 43–50, (2014). [doi:10.1145/2608628.2608680](https://doi.org/10.1145/2608628.2608680) [[Distinguished Student Author Award](#)].

Computation of the unipotent radical of the differential Galois group for a parameterized second-order linear differential equation. Advances in Applied Mathematics **57**, 44–59, (2014). [doi:10.1016/j.aam.2014.03.001](https://doi.org/10.1016/j.aam.2014.03.001).

A Galois-theoretic proof of the differential transcendence of the incomplete Gamma function. Journal of Algebra **389**, 119–127, (2013). [doi:10.1016/j.jalgebra.2013.04.037](https://doi.org/10.1016/j.jalgebra.2013.04.037)

Editorial work:

(Editor) *Proceedings of the 2018 International Symposium on Symbolic and Algebraic Computation (ISSAC'18)*, ACM Press, 2018.
Available at the [ACM Digital Library](#).

Other works:

An algorithmic approach to the differential Galois theory of second-order linear differential equations with differential parameters. Ph.D. Thesis, The Graduate Center, CUNY, (2014). http://academicworks.cuny.edu/gc_etds/337/

Examples of computation of parameterized differential Galois groups for some second-order linear differential equations with one differential parameter. Maple worksheet, (2015).
Available at: <http://www.utdallas.edu/~arreche/>

Computing the differential Galois group of a one-parameter family of second order linear differential equations. Preprint, (2012). [arXiv:1208.2226](https://arxiv.org/abs/1208.2226).

SELECTED
FUNDING &
AWARDS

| | |
|---|-----------|
| <u>Sloan Foundation through UTRGV, Co-PI, Equitable Pathways Seed Grant.</u> “Building Equitable Pathways to Math Graduate Education”; \$249,269 (UTD subaward through UTRGV: \$75,400). Alfred P. Sloan Foundation. | 2021–2023 |
| <u>NS&M Outstanding Teaching Award for Tenure-Track Faculty</u> School of Natural Sciences and Mathematics, The University of Texas at Dallas. | 2020–2021 |
| <u>NSF, PI, CCF–1815108.</u> “AF: Small: Computation of Functional Relations Among Solutions of Difference and Differential Equations”; \$203,416. National Science Foundation. | 2018–2021 |
| <u>NSF, Senior Personnel, DMS–1820765.</u> “Collaborative Research: Enhancing Diversity in the Mathematics Graduate Applicant Pool”; \$360,073. National Science Foundation. | 2018–2021 |
| <u>Postdoctoral Visitor Appointment.</u> Fields Institute for Research in Mathematical Sciences. | Fall 2015 |
| <u>NSF Alliance Postdoctoral Fellowship.</u> Alliance for Building Faculty Diversity in the Mathematical Sciences, National Science Foundation. | 2014–2017 |
| <u>ISSAC 2014 Distinguished Student Author Award.</u> SIGSAM, Association for Computing Machinery. Presented in Kobe, Japan, at 39th International Symposium on Algebraic and Symbolic Computation. | 2014 |
| <u>NSF Graduate Research Fellowship.</u> National Science Foundation. | 2009–2014 |
| <u>Ford Foundation Predoctoral Fellowship.</u> Ford Foundation and The National Academies. | 2009–2014 |

UNDERGRAD
TEACHING

| | |
|--|------------------------------------|
| <u>Instructor.</u> (Calculus I) The University of Texas at Dallas. | Spring 2021; Fall 2017 & 2019–2023 |
| <u>Instructor.</u> (Abstract Algebra II) The University of Texas at Dallas. | Spring 2018–2024 |
| <u>Instructor.</u> (Calculus for Life and Management Sciences B) North Carolina State University. | Fall 2016 & 2014 |
| <u>Instructor.</u> (Topics in Contemporary Mathematics) North Carolina State University. | Spring 2016 |
| <u>Adjunct Instructor.</u> (Precalculus) Brooklyn College, City University of New York. | Spring 2014 & Fall 2013 |
| <u>Tutor.</u> (Thinking Mathematically) Percy Ellis Sutton SEEK Program Brooklyn College, City University of New York. | Summer 2013 |

Instructor. (Apollonian Circle Packings) Summer 2012
RTG Undergraduate Summer Program, New York City, NY.

GRADUATE TEACHING

Instructor. (Combinatorics and Graph Theory) Spring 2023–2024; Fall 2021–2023
The University of Texas at Dallas.

Instructor. (Topics in Mathematics - Level 6: Abstract Algebra II) Spring 2022
The University of Texas at Dallas.

Instructor. (Principles and Techniques of Applied Mathematics II) Spring 2019
The University of Texas at Dallas.

Instructor. (Topics in Mathematics - Level 6: Differential Galois Theory) Fall 2018
The University of Texas at Dallas.

MENTORING

Postdoctoral

- Yi Zhang, The University of Texas at Dallas. Fall 2018–Spring 2020
Assistant Professor, Department of Fundamental Mathematics
Xi'an Jiaotong-Liverpool University

Doctoral

- Misha Billah Spring 2024–Present
- Matthew Babbitt Fall 2021–Present
- Hari Prasad Sitaula 2019–2023
Assistant Professor, Department of Mathematical Sciences
Montana Technological University

Undergraduate

- Avery Bainbridge, Ben Obert, and Alavi Ullah Summer 2023–Fall 2023
The University of Texas at Dallas
Sloan REU project: “Complex Reflection Groups as Differential Galois Groups”
 - Niko Laohoo & Nick Robinson, The University of Texas at Dallas Summer 2022
Sloan REU project: “Geometry and Dynamics of Unusual Billiards”
(mentored jointly with V. Dragovic).
 - Jesús Emilio Domínguez Russell, Universidad Autónoma de Sinaloa. Summer 2019
UT Dallas – Mexico Summer Research Program 2019
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SELECTED TALKS

Complex reflections groups as differential Galois groups. Differential Algebra and Related Topics (DART XII), Universität Kassel, Kassel, Germany, April 2024.

Galois groups of functional equations: theory, algorithms, and applications (Plenary talk). Functional Equations in Limoges Conference (FELIM 2024), Université de Limoges, Limoges, France, March 2024.

Complex reflection groups as differential Galois groups. Applied Mathematics Seminar, Universidad Politécnica de Madrid, Madrid, Spain, January 2024.

Complex reflection groups as differential Galois groups. Algebra and Representation Theory Seminar, Department of Mathematics, The University of Oklahoma, Norman, OK, November 2023.

Complex reflection groups as differential Galois groups. Algebra and Combinatorics Seminar, The University of Texas at Dallas, Richardson, TX, October 2023.

Complex reflection groups as differential Galois groups. Kolchin Seminar in Differential Algebra, Graduate Center of the City University of New York, Online, September 2023.

Mahler discrete residues and summability for rational functions. Symbolic Analysis Workshop, Foundations of Computational Mathematics Conference (FoCM'23), Paris, France, June 2023.

Galois groups for linear integrable systems of differential and difference equations over elliptic curves. Symbolic Analysis Workshop, Foundations of Computational Mathematics Conference (FoCM'23), Paris, France, June 2023.

Twisted Mahler discrete residues. Special Session on Computational Differential and Difference Algebra and its Applications, Applications of Computer Algebra (ACA'22), Gebze Technical University, Istanbul, Turkey, August 2022.

Mahler discrete residues and summability for rational functions. International Symposium on Symbolic and Algebraic Computation (ISSAC'22), Université de Lille, Villeneuve-d'Ascq, France, July 2022.

Differential transcendence criteria for second-order linear difference equations and elliptic hypergeometric functions. GRACIA-RedMat: Grupos, Relatividad, Álgebra, Combinatoria, Relatividad y Aritmética (Online), December 2021.

Mahler residues and telescopers for rational functions. Minisymposium on Algorithmic Algebra and Geometry, SIAM Texas-Louisiana Section Fourth Annual Meeting, South Padre Island, Texas, November 2021.

Normal subgroups of complex reflection groups. Minisymposium on Symbolic Combinatorics, SIAM Conference on Applied Algebraic Geometry (AG'21 Online), August 2021.

Mahler residues and telescopers for rational functions. Special Session on Computational Differential and Difference Algebra and its Applications, Applications of Computer Algebra (ACA'21 Online), July 2021.

Mahler residues and telescopers for rational functions. Special Session on Symbolic Computation: Theory, Algorithms and Applications, Mathematical Congress of the Americas (MCA'21 Online), July 2021.

Grothendieck topologies for differential algebraic varieties. Online Workshop in Memory of Ray Hoobler, Kolchin Seminar in Differential Algebra, Graduate Center of the City University of New York, New York, NY, April 2021.

Normal reflection subgroups. Formal Power Series and Algebraic Combinatorics (FPSAC'20 Online), July 2020.

Differential transcendence of elliptic hypergeometric functions through Galois theory. Differential Algebra and Related Topics (DART-X), City University of New York, New York, NY, February 2020.

Differential transcendence of elliptic hypergeometric functions through Galois theory. Special Session on Computational Differential and Difference Algebra and its Applications, Applications of Computer Algebra (ACA'19), Montréal, Canada, July 2019.

Differential transcendence of elliptic hypergeometric functions through Galois theory. Workshop on Elliptic Integrable Systems, Special Functions and Quantum Field Theory, Nordic Institute for Theoretical Physics (NORDITA), Stockholm, Sweden, June 2019.

Differential Galois theory for difference equations and hypertranscendence. AMS Special Session on Research by Postdocs of the Alliance for Diversity in Mathematics, Joint Mathematics Meetings, San Diego, CA, January 2018.

Differential Galois theories for difference equations and hypertranscendence. AMS Special Session on Applicable and Computational Algebraic Geometry, Fall Central Sectional Meeting, University of North Texas, Denton, TX, September 2017.

Algorithmic aspects of Galois theories for functional equations and hypertranscendence. Overview lecture at the Workshop on Differential Galois Theory and Differential Algebraic Groups, Fields Institute, Toronto, Canada, July 2017.

Projectively integrable linear difference equations and their Galois groups. Differential Algebra and Related Topics (DART-VII), City University of New York, New York, NY, October 2016.

Projectively integrable linear difference equations and their Galois groups. Thematic Session on Computational Differential and Difference Algebra, Congreso Latinoamericano de Matemáticas (V CLAM'16), Barranquilla, Colombia, July 2016.

Projectively integrable linear difference equations and their Galois groups. Special Session on Difference Galois Theory, International Conference on Symmetries and Integrability of Difference Equations (SIDE12), Sainte-Adèle, Canada, July 2016.

Projectively integrable linear difference equations and their Galois groups. Kolchin Workshop on Differential Algebra, City University of New York, New York, NY, May 2016.

On the computation of the difference-differential Galois group for a second-order linear difference equation. AMS Special Session on Algebraic Theory of Differential and Functional Equations, Joint Mathematics Meetings, Seattle, WA, January 2016.

Computing Galois groups for functional equations. AMS Special Session on Research by Postdocs of the Alliance for Diversity in Mathematics, Joint Mathematics Meetings, Seattle, WA, January 2016.

Galois theories for functional equations. Galois Seminar, University of Pennsylvania, Philadelphia, PA, December 2015.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Mathematics Colloquium, University of New Mexico, Albuquerque, NM, December 2015.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Model Theory Seminar, McMaster University, Hamilton, Canada, October 2015.

Galois theories for functional equations. Homological Methods Seminar, University of Toronto, Toronto, Canada, October 2015.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Workshop on Symbolic Combinatorics and Computational Differential Algebra, Thematic Program on Computer Algebra, Fields Institute, Toronto, Canada, September 2015.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Differential Algebra and Related Topics (DART-VI), International Congress on Industrial and Applied Mathematics (ICIAM'15), Beijing, China, August 2015.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Special Session on Computational Differential and Difference Algebra, Applications of Computer Algebra (ACA'15), Kalamata, Greece, July 2015.

Computing the parameterized differential Galois group of a second-order linear differential equation with parameters. Symbolic Computation Seminar, North Carolina State University, Raleigh, North Carolina, February 2015.

Computing the parameterized differential Galois group of a second-order linear differential equation with parameters. Symbolic Analysis Workshop, Foundations of Computational Mathematics Conference (FoCM'14), Montevideo, Uruguay, December 2014.

On the computation of the difference-differential Galois group for a second-order linear difference equation. Kolchin Seminar in Differential Algebra, Graduate Center of the City University of New York, New York, NY, December 2014.

Computing the differential Galois group of a parameterized second-order linear differential equation. International Symposium on Symbolic and Algebraic Computation (ISSAC'14), Kobe University, Kobe, Japan, July 2014.

Computing differential Galois groups of parameterized second-order linear differential equations. Special Session on Computational Differential and Difference Algebra, Applications of Computer Algebra (ACA'14), Fordham University, Bronx, NY, July 2014.

Computing unipotent radicals of parameterized Picard-Vessiot groups: the case of second-order equations. AMS Special Session on Differential Algebra and Galois Theory, Spring Central Sectional Meeting, Texas Tech University, Lubbock, TX, April 2014.

A Picard-Vessiot topology for differential schemes. AMS Special Session on Arithmetic and Differential Algebraic Geometry, Western Spring Sectional Meeting, University of New Mexico, Albuquerque, NM, April 2014.

A Galois-theoretic proof of the differential transcendence of the incomplete Gamma function. Differential Algebra and Related Topics (DART-V), Polytech'Lille, Lille, France, June 2013.

Solving Linear Differential Equations with Parameters: An Algorithmic Approach with Applications to Arithmetic Geometry. Workshop on Differential Schemes and Differential Cohomology, Banff International Research Station and University of Calgary, Canada, June 2012.

Generalizing Kovacic's Algorithm for Second Order Linear Differential Equations with Parameters. Joint Mathematics Meetings, Boston, MA, January 2012.

SERVICE

Reviewer. 2024–present
Office of Research and Innovation
The University of Texas at Dallas

Strategic Planning Committee Member. 2023–present
School of Natural Sciences and Mathematics
The University of Texas at Dallas

Mentor. Summer 2023
Research Experience for Undergraduates on “Reflection Groups as Galois Groups”
Sloan Equitable Pathways Seed Grant
Alfred P. Sloan Foundation (through UT Rio Grande Valle and UT Dallas)

Instructor. Summer 2022
Latin America and the Caribbean Mathematical School (EMALCA 2022 RD)
Universidad Autónoma de Santo Domingo, Dominican Republic.

Mentor. (with V. Dragovic) Summer 2022
Research Experience for Undergraduates on “Unusual Billiards”
Sloan Equitable Pathways Seed Grant
Alfred P. Sloan Foundation (through UT Rio Grande Valle and UT Dallas)

Program Committee Member. Spring 2021
ISSAC 2021, Saint Petersburg, Russia.

Proceedings Editor and Registration Chair. Spring 2018
ISSAC 2018, New York, NY.

Co-organizer. (with M. Arnold, M. Dabkowski, and N. Williams) Fall 2017–present
Algebra and Combinatorics Seminar
The University of Texas at Dallas

Referee. 2015–present

- Proceedings of the American Mathematical Society
- Journal of Symbolic Computation
- Advances in Applied Mathematics
- Communications in Contemporary Mathematics
- International Symposium on Symbolic and Algebraic Computation
- Journal of Algebra
- Communications in Algebra
- Mathematical Aspects of Computer and Information Sciences
- Fundamenta Mathematica

Team Tutor. Fall 2015
Puerto Rico Delegation,
Olimpiada Iberoamericana de Matemáticas, Puerto Rico.

Co-organizer. (with A. Ovchinnikov and M. Wibmer). July 2015
Special Session on Computational Differential and Difference Algebra,
Applications of Computer Algebra 2015, Kalamata, Greece.

PROFESSIONAL MEMBERSHIPS

Special Interest Group in Symbolic and Algebraic Manipulation (SIGSAM). 2016–present

Association for Computing Machinery (ACM). 2016–present

American Mathematical Society (AMS). 2009–present

LANGUAGES

Spanish (native).
English (fluent).
French (written: good; spoken: competent).
German (written: competent; spoken: basic).