

Dermot McCarthy

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EMPLOYMENT

Associate Professor, Dept. of Mathematics & Statistics, Texas Tech University. Sep. 2019 -
Assistant Professor, Dept. of Mathematics & Statistics, Texas Tech University. Sep. 2013 - Aug. 2019
Visiting Assistant Professor, Dept. of Mathematics, Texas A&M University. Sep. 2010 - Aug. 2013

EDUCATION

Ph.D. Mathematics, University College Dublin, Ireland. Sep. 2010
B.Sc. Mathematics (First Class Honors), Dublin Institute of Technology, Ireland. Oct. 2004

RESEARCH INTERESTS

Number theory, modular forms (elliptic & Siegel), Jacobi forms, hypergeometric functions (classical, finite field & p -adic), properties of algebraic varieties, graph theory, Ramsey theory.

PUBLICATIONS

Refereed Journal Articles[†]

22. Splitting hypergeometric functions over roots of unity,
Dermot McCarthy & Mohit Tripathi,
submitted for publication, 23 pages.
21. Transitive subtournaments of k^{th} power Paley digraphs and improved lower bounds for Ramsey numbers,
Dermot McCarthy & Mason Springfield,
Graphs and Combinatorics, to appear, 21 pages.
20. The number of \mathbb{F}_q -points on diagonal hypersurfaces with monomial deformation,
Dermot McCarthy,
Pacific Journal of Mathematics, 328-2 (2024), 339–359.
19. Orbits of finite field hypergeometric functions and complete subgraphs of generalized Paley graphs,
Dermot McCarthy & Mason Springfield,
Involve, to appear, 8 pages.
18. Eigenvalues & Fourier coefficients of degree two Siegel eigenforms constructed from Igusa theta constants,
Dermot McCarthy,
Research in Number Theory (2022) 8:88.

[†]Copies of all articles can be found on my website.

17. Hypergeometric functions over finite fields and modular forms: a survey and new conjectures, Madeline Locus Dawsey & Dermot McCarthy, *Operator Theory: Advances and Applications* 285 (2021), 41–56.
16. Generalized Paley graphs and their complete subgraphs of orders three and four, Madeline Locus Dawsey & Dermot McCarthy, *Research in the Mathematical Sciences* (2021) 8:18.
15. Sequences, modular forms and cellular integrals, Dermot McCarthy, Robert Osburn & Armin Straub, *Mathematical Proceedings of the Cambridge Philosophical Society* 168(2) (2020), 379–404.
14. On a question of Zhang, Dermot McCarthy & Yong Yang, *Communications in Algebra* (2019) 47:12, 5133–5134.
13. Apéry-like numbers and families of newforms with complex multiplication, Alexis Gomez, Dermot McCarthy & Dylan Young, *Research in Number Theory* (2019) 5:5.
12. The number of \mathbb{F}_p -points on Dwork hypersurfaces and hypergeometric functions, Dermot McCarthy, *Research in the Mathematical Sciences* (2017) 4:4.
11. Multiplicative relations for Fourier coefficients of degree 2 Siegel eigenforms, Dermot McCarthy, *Journal of Number Theory*, 170 (2017), 263–281.
10. Hypergeometric type identities in the p -adic setting and modular forms, Jenny G. Fuselier & Dermot McCarthy, *Proceedings of the American Mathematical Society*, 144 (2016), no. 4, 1493–1508.
9. A finite field hypergeometric function associated to eigenvalues of a Siegel eigenform, Dermot McCarthy & Matthew A. Papanikolas, *International Journal of Number Theory* 11 (2015), no. 8, 2431–2450.
8. Summation identities and special values of hypergeometric series in the p -adic setting, Rupam Barman, Neelam Saikia & Dermot McCarthy, *Journal of Number Theory* 153 (2015), 63–84.
7. The trace of Frobenius of elliptic curves and the p -adic gamma function, Dermot McCarthy, *Pacific Journal of Mathematics* 261 (2013), no. 1, 219–236.
6. Transformations of well-poised hypergeometric functions over finite fields, Dermot McCarthy, *Finite Fields and Their Applications* 18 (2012), no. 6, 1133–1147.
5. On a supercongruence conjecture of Rodriguez-Villegas, Dermot McCarthy, *Proceedings of the American Mathematical Society* 140 (2012), no. 7, 2241–2254.

4. Extending Gaussian hypergeometric series to the p -adic setting,
Dermot McCarthy,
International Journal of Number Theory 8 (2012), no. 7, 1581–1612.
3. Binomial coefficient-harmonic sum identities associated to supercongruences,
Dermot McCarthy,
Integers 11 (2011), A37, 8 pp.
2. ${}_3F_2$ hypergeometric series and periods of elliptic curves,
Dermot McCarthy,
International Journal of Number Theory 6 (2010), no. 3, 461–470.
1. A p -adic analogue of a formula of Ramanujan,
Dermot McCarthy & Robert Osburn,
Archiv der Mathematik 91 (2008), no. 6, 492–504.

Book Chapter

1. Sequences, modular forms and cellular integrals,
Dermot McCarthy, Robert Osburn & Armin Straub,
2017 MATRIX Annals, edited by David R. Wood et al., MATRIX Book Series 2, Springer, 2019.

GRANT FUNDING

Awarded

- *Faculty Travel Grant*, Principal Investigator,
Office of Research & Innovation, Texas Tech University, Spring 2023. Total award \$1,000.
- *Hypergeometric Functions and Modular Forms*, Principal Investigator,
Simons Foundation, Collaboration Grants for Mathematicians (#353329),
Sep. 2015 - Aug. 2020 (extended to Aug. 2022). Total award \$35,000.
- *Texas-Oklahoma Representations and Automorphic Forms Conference Series*, Senior Personnel
National Science Foundation (DMS 1854626), Feb. 2019 - Jan. 2023. Total award \$16,000.
- *Texas-Oklahoma Representations and Automorphic Forms Conference Series*, Senior Personnel
National Science Foundation (DMS 1600473), Feb. 2016 - Jan. 2019. Total award \$13,000.

Pending

- *Number Theory and Special Functions*, Principal Investigator,
Simons Foundation, Sep. 2024 - Aug. 2029. Total \$42,000.

Other Proposals Submitted

- *Initiative for Mathematics, Programming, and Research in Texas (IMPART)*, Principal Investigator,
National Science Foundation, Sep. 2023 - Aug. 2026. Total \$393,586.
- *Hypergeometric Motives and Modular Forms*, Principal Investigator,
Simons Foundation, Sep. 2023 - Aug. 2028. Total \$42,000.
- *Modular Connections in Higher Dimensions*, Principal Investigator,
National Science Foundation, Jun. 2023 - May. 2026. Total \$236,273.

- *Modular Forms and Hypergeometric Functions*, Principal Investigator, Simons Foundation, Sep. 2022 - Aug. 2027. Total \$42,000.
- *Siegel Modular Forms*, Principal Investigator, Simons Foundation, Sep. 2021 - Aug. 2026. Total \$42,000.
- *Modular Forms and Hypergeometric Functions*, Principal Investigator, Simons Foundation, Sep. 2020 - Aug. 2025. Total \$42,000.
- *Siegel Modular Forms: Hecke Theory and Multiplicity One*, Principal Investigator, National Science Foundation, Sep. 2019 - Aug. 2024. Total \$404,681.
- *Hypergeometric functions, in the finite field and p -adic settings, and modular forms*, Principal Inv., National Science Foundation, Jun. 2017 - May. 2020. Total \$113,984.
- *Hypergeometric functions, in the finite field and p -adic settings, and modular forms*, Principal Inv., National Science Foundation, Jun. 2015 - May. 2018. Total \$111,237.
- *Unified Hypergeometric Functions and their Applications*, Principal Investigator, National Science Foundation, Jun. 2011 - May. 2014. Total \$89,998.

PRESENTATIONS

Invited Talks

The University of Texas at Tyler, Number Theory and Combinatorics Seminar.	Apr. 2024
Tulane University, Algebra and Combinatorics Seminar.	Sep. 2023
Louisiana State University, Algebra and Number Theory Seminar.	Sep. 2023
Joint Mathematics Meetings, Boston, MA, AMS Special Session on Modular Forms, Hypergeometric Functions, Character Sums and Galois Representations.	Jan. 2023
Beijing Institute of Mathematical Sciences and Applications, Number Theory Seminar.	Nov. 2022
Joint Mathematics Meetings, Virtual, AMS Special Session on Modular Forms and Combinatorics.	Apr. 2022
The University of Texas at Tyler, Number Theory and Combinatorics Seminar. (<i>Canceled due to COVID</i>)	Apr. 2020
Texas State University, Dept. of Mathematics Colloquium.	Oct. 2019
AMS Fall Central Sectional Meeting, Denton, TX, Special Session on Numbers, Functions, Transcendence, and Geometry.	Sep. 2017
Texas A&M University, Number Theory Seminar.	Nov. 2014
The University of Oklahoma, Algebra and Representation Theory Seminar.	Oct. 2014
Texas Tech University, Dept. of Mathematics & Statistics Colloquium.	Feb. 2013
AMS-MAA Joint Meetings, San Diego, CA, Special Session on L -functions and Arithmetic Geometry.	Jan. 2013
AMS Fall Western Sectional Meeting, Tucson, AZ, Special Session on Automorphic and Modular Forms.	Oct. 2012

University of Illinois at Urbana-Champaign, Number Theory Seminar.	Sep. 2012
University of Texas, Algebra, Number Theory and Combinatorics Seminar.	Mar. 2012
University of North Texas, Millican Colloquium.	Feb. 2012
Iowa State University, Combinatorics, Algebra and Number Theory Seminar.	Apr. 2011
Fields Institute, Toronto, Canada, Workshop on Algebraic Varieties.	Mar. 2011
Texas A&M University, Number Theory Seminar.	Nov. 2009
University of Warwick, England, Number Theory Seminar.	May 2009
University of Nottingham, England, Number Theory Day.	May 2009

Contributed Talks

AMS Spring Central and Western Joint Sectional Meeting, University of Hawai'i at Mānoa, Session on Number Theory, Commutative Algebra and Algebraic Geometry.	Mar. 2019
Texas-Oklahoma Representations and Automorphic Forms IX, University of Oklahoma.	Apr. 2018
32nd Automorphic Forms Workshop, Tufts University.	Mar. 2018
Texas-Oklahoma Representations and Automorphic Forms VII, University of North Texas.	Apr. 2016
30th Automorphic Forms Workshop, Wake Forest University.	Mar. 2016
Palmetto Number Theory Series XIX, University of South Carolina.	Dec. 2012
26th Automorphic Forms Workshop, University of British Columbia, Canada.	Apr. 2012
25th Automorphic Forms Workshop, Oregon State University.	Mar. 2011
6th Midwest Number Theory Conference for Graduate Students, Madison, Wisconsin.	Nov. 2009
26th Journées Arithmétiques, Saint-Etienne, France.	July 2009
Arizona Winter School, University of Arizona, Group Presentation.	Mar. 2008

Departmental Seminars

Texas Tech University, Algebra & Number Theory Seminar.	Feb. 2019
Texas Tech University, Algebra & Number Theory Seminar.	Mar. 2018
Texas Tech University, Algebra & Number Theory Seminar.	Feb. 2018
Texas Tech University, Algebra & Number Theory Seminar.	Apr. 2017
Texas Tech University, Algebra Seminar.	Mar. 2016
Texas Tech University, SIAM Faculty Research Seminar.	Oct. 2015
Texas Tech University, Algebra Seminar.	Nov. 2014

Texas Tech University, Applied Mathematics Seminar.	Nov. 2014
Texas Tech University, Algebra Seminar.	Oct. 2013
Texas A&M University, Postdoc Colloquium.	Oct. 2011
Texas A&M University, Postdoc Colloquium.	Oct. 2010
Texas A&M University, Number Theory Seminar.	Oct. 2010
University College Dublin, Ireland, Postgraduate Research Seminar.	Mar. 2010
University College Dublin, Ireland, Number Theory Seminar.	Oct. 2009
University College Dublin, Ireland, Postgraduate Research Seminar.	Jan. 2009
University College Dublin, Ireland, Postgraduate Research Seminar.	Mar. 2008
University College Dublin, Ireland, Postgraduate Research Seminar.	Apr. 2007

CONFERENCES ATTENDED

Joint Mathematics Meetings, Boston, MA.	Jan. 2023
Texas-Oklahoma Representations and Automorphic Forms (TORA) XI, Oklahoma State University.	Apr. 2022
Joint Mathematics Meetings, Virtual	Apr. 2022
AMS Spring Central and Western Joint Sectional Meeting, University of Hawai'i at Mānoa.	Mar. 2019
Hawai'i Number Theory (HINT), University of Hawai'i at Mānoa.	Mar. 2019
Texas-Oklahoma Representations and Automorphic Forms (TORA) IX, University of Oklahoma.	Apr. 2018
32nd Automorphic Forms Workshop, Tufts University.	Mar. 2018
AMS Fall Central Sectional Meeting, Denton, TX.	Sep. 2017
Texas-Oklahoma Representations and Automorphic Forms (TORA) VIII, Oklahoma State University.	Apr. 2017
Texas-Oklahoma Representations and Automorphic Forms (TORA) VII, The University of North Texas.	Apr. 2016
30th Automorphic Forms Workshop, Wake Forest University.	Mar. 2016

Texas-Oklahoma Representations and Automorphic Forms (TORA) VI, The University of Oklahoma.	Mar. 2015
Challenges of Identifying Integer Sequences, Center for Discrete Mathematics and Theoretical Computer Science, Rutgers University.	Oct. 2014
Workshop on Siegel Modular Forms, The University of Oklahoma.	Oct. 2014
Applications of Automorphic Forms in Number Theory and Combinatorics, Louisiana State University.	Apr. 2014
AMS Spring Central Sectional Meeting, Texas Tech University.	Apr. 2014
AMS-MAA Joint Meetings, San Diego, CA.	Jan. 2013
Palmetto Number Theory Series XIX University of South Carolina	Dec. 2012
AMS Fall Western Sectional Meeting, Tucson, AZ.	Oct. 2012
AIM Workshop: Hypergeometric Motives (Invited Participant), International Centre for Theoretical Physics, Trieste, Italy.	Jun. 2012
Hypergeometric Series and their Generalizations in Algebra, Geometry, Number Theory and Physics, Institut Henri Poincaré, Paris, France.	May 2012
26th Automorphic Forms Workshop, University of British Columbia, Vancouver, Canada.	Apr. 2012
Texas-Oklahoma Representations and Automorphic Forms Conference, University of North Texas.	Sep. 2011
Atkin Memorial Lecture and Conference, University of Illinois at Chicago.	May 2011
25th Automorphic Forms Workshop, Oregon State University.	Mar. 2011
Workshop on Algebraic Varieties, Fields Institute, Toronto, Canada.	Mar. 2011
The Number Theory of Partitions, Emory University, Atlanta, Georgia.	Jan. 2011
AMS-MAA Joint Mathematics Meetings, New Orleans, LA.	Jan. 2011
6th Midwest Number Theory Conference for Graduate Students, Madison, WI.	Nov. 2009
Midwest Number Theory Day, Madison, WI.	Nov. 2009
Fq9 - 9th International Conference on Finite Fields and their Applications, Dublin, Ireland.	Jul. 2009

26th Journées Arithmétiques, Saint-Etienne, France.	Jul. 2009
Number Theory Day, University of Nottingham, England.	May 2009
Arizona Winter School - Special Functions and Transcendence, Tucson, Arizona.	Mar. 2008
ECC2007 - 11th Workshop on Elliptic Curve Cryptography, Dublin, Ireland.	Sep. 2007
25th Journées Arithmétiques, Edinburgh, Scotland.	Jul. 2007

RESEARCH MENTORING

Postdoctoral

- Dr. Mohit Tripathi, Sep. 2023 - present.
- Dr. Cezar Lupu, Sep. 2018 - Aug. 2021.

Chair of Doctoral Committees

- Mason Springfield, Topics in Siegel modular forms, May 2025 (expected).
- Dylan Rudy (co-chair with Dr. Monico), Vulnerabilities of some semidirect products in Diffie-Hellman key exchanges, May 2021.

Member of Doctoral Committees

- Yang Zhang: An investigation of some public key exchange cryptosystems, May 2017.
- Pritha Chakraborty: Extremal problems in Bergman spaces, May 2016.
- Arunabha Biswas: Some aspects of higher Mahler measure, Aug. 2015.

Chair of Masters Committee

- Lily Young: Apéry-like numbers and families of newforms with complex multiplication, May 2020.

Member of Masters Committee

- Sergio Baez: The LLL Algorithm, Aug. 2020.

Undergraduate Research

- Jack Weiland, Character sum evaluations, Jun. 2020 - Aug. 2020.
- Michael Keeler, Combinatorics of quadratic forms, Sep 2019 - May 2020.
- Alexis Gomez & Dylan Young, Apéry-like numbers and families of newforms with complex multiplication, Jan. 2018 - Jul. 2018.
- Miranda Dominick, The least prime congruent to one modulo n , Jan. 2016 - May 2017.
- Samuel Tackitt, Igusa theta constants and Siegel modular forms, Oct. 2016 - Dec. 2016.
- Jianna Davenport, Binomial sums and supercongruences, Aug. 2014 - May 2015.

HONORS & AWARDS

- Mathematical Association of America (Texas Tech Chapter) Professor of the Year 2017.
- W. Dayawansa - TTU Math Research Award 2017.
- Ad Astra Research Scholarship, University College Dublin, 4 years, 2006-2010.

SERVICE

Journal Referee and Grant Review

- I have refereed over 60 papers in the last 11 years for the following journals:
 - Acta Arithmetica;
 - AMS Contemporary Mathematics;
 - Ars Combinatoria;
 - Bulletin of the London Mathematical Society;
 - Canadian Mathematical Bulletin;
 - Colloquium Mathematicum;
 - Discussiones Mathematicae Graph Theory
 - Finite Fields and their Applications;
 - Functiones et Approximatio;
 - Hiroshima Mathematical Journal
 - International Journal of Number Theory;
 - Journal of Algebra;
 - Journal of Integer Sequences;
 - Journal of Mathematical Analysis and Applications;
 - Journal of Number Theory;
 - Mathematical Research Letters;
 - Mathematica Slovaca;
 - Monatshefte für Mathematik;
 - Pacific Journal of Mathematics;
 - Proceedings of the American Mathematical Society;
 - The Royal Society of Edinburgh, Proceedings A;
 - Publicationes Mathematicae Debrecen;
 - Research in Number Theory;
 - Research in the Mathematical Sciences;
 - The Ramanujan Journal; and
 - Utilitas Mathematica.
- Grant proposal reviewer for
 - National Science Centre of Poland;
 - National Science Foundation;
 - National Security Agency's Mathematical Sciences Program; and
 - The Simons Foundation.

Conference and Seminar Organizing

- Member of organizing committee for Texas-Oklahoma Representations and Automorphic forms (TORA) conference series, 2015 - 2023.
- Organizer of the Texas Tech University Department of Mathematics & Statistics' Algebra & Number Theory Seminar, Aug. 2016 - Dec. 2020.

- Organizer, with Dr. Cezar Lupu, of the Special Session on Special Functions in Number Theory, AMS Spring Western Sectional Meeting, California State University, May 2-3, 2020.
(*Canceled, due to COVID, after all speakers, abstracts and schedule had been finalized*)
- Organizer of the Special Session on Recent Developments in Number Theory, AMS Central Sectional Meeting, Texas Tech University, April 11-13, 2014.
- Organizer of the Texas A&M University Number Theory Seminar, 2010-2013.

Departmental Committees

- Graduate Committee (Elected), Sep. 2023 - present.
- Algebra Prelim. Examination Committee, Jan. 2016 - present.
- Executive Committee (Elected), Sep. 2021 - Aug. 2023.
- Third Year Review Committee, Committee Chair (Appointed), Spring 2022.
- Hiring Strategy Committee (Appointed), Fall 2020.
- Undergraduate Committee (Elected), Sep. 2014 - Aug. 2016 and Sep. 2018 - Aug. 2020.

Recommendation Letters

- In the last 10 years, I have written recommendation letters for 30 different students in support of their applications for scholarships, graduate school and jobs.

College of Arts & Sciences Committees

- Grade Appeals Board (Appointed), Jan. 2024.

University Committees

- Mathematics Subcommittee of Texas Tech's Core and Multicultural Curriculum Committee (Invited), Sep. 2022 - present.

Outreach and Engagement

- TTU Math Circle: Founder, Organizer and Lead Mentor, Sep. 2013 - Dec. 2016.

TEACHING

Texas Tech University

- MATH 1321 Trigonometry.
- MATH 2360 Linear Algebra.
- MATH 3360 Foundations of Algebra I.
- MATH 4360 Foundations of Algebra II.
- MATH 4362 Theory of Numbers.
- MATH 4363 Combinatorics.
- MATH 5315 Introduction to Set Theory (Graduate).
- MATH 5317 Introduction to Modern Algebra (Graduate).
- MATH 5326 Modern Algebra I (Graduate).

- MATH 5327 Modern Algebra II (Graduate).
- MATH 5362 Theory of Numbers (Graduate).

Texas A&M University

- Math 141 Business Mathematics I.
- Math 151 Engineering Mathematics I.
- Math 171 Analytic Geometry and Calculus.
- Math 251 Engineering Mathematics III.
- Math 304 Linear Algebra.

University College Dublin

- MST20010 Algebraic Structures.
- Teaching Assistant on almost 20 different undergraduate courses covering various topics, such as differential and integral calculus, linear algebra, geometry, elementary number theory and financial mathematics.