

Caroline L. Turnage-Butterbaugh

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CURRENT EMPLOYMENT

Carleton College: Assistant Professor of Mathematics, September 2018 – present

PREVIOUS PROFESSIONAL POSITIONS

Duke University: William W. Elliott Assistant Research Professor, August 2015–August 2018

Mathematical Sciences Research Institute (MSRI): Postdoctoral Fellow, Spring 2017

North Dakota State University: Postdoctoral Research Fellow, August 2014–May 2015

Williams College: Postdoctoral Undergraduate Research Mentor, Summer 2014

EDUCATION

University of Mississippi: Ph.D. in mathematics, May 2014

Wake Forest University: M.A. in mathematics, May 2008

Wofford College: B.A. in mathematics & French, *magna cum laude*, May 2006

RESEARCH INTERESTS

analytic and algebraic number theory, in particular the zeros of the Riemann zeta-function, L -functions, and class groups of number fields

PREPRINTS

1. *Some explicit and unconditional results on gaps between zeroes of the Riemann zeta-function*, (with T. Trudgian and A. Simonič), preprint available at <https://arxiv.org/abs/2010.10675>

PUBLICATIONS

1. *On a conjecture for ℓ -torsion in class groups of number fields: from the perspective of moments*, (with L. B. Pierce and M. Matchett Wood), to appear in *Mathematical Research Letters*, available at <https://arxiv.org/abs/1902.02008>
2. *An effective Chebotarev density theorem for families of number fields with an application to ℓ -torsion in class groups* (with L. B. Pierce and M. Matchett Wood), *Inventiones Mathematicae* **219** (2020), no. 2, 701–778.
3. *Extremal primes of elliptic curves without complex multiplication* (with C. David, A. Gafni, A. Malik, and N. Prabhu), *Proceedings of the American Mathematics Society* **148** (2020), no. 3, 929–943.
4. *On r -gaps between zeros of the Riemann zeta-function* (with J. B. Conrey), *Bulletin of the London Mathematical Society*, **50** (2018), no. 2, 349–356.
5. *Gaps between zeros of Dedekind zeta-functions of quadratic number fields. II*, (with H. M. Bui and W. P. Heap), *Quarterly Journal of Mathematics*, **67** (2016) no. 3, 467–482.
6. *Consecutive primes in tuples* (with W. D. Banks and T. Freiberg), *Acta Arithmetica*, **167**, (2015), 261–266.
7. *Gaps between zeros of Dedekind zeta-functions of quadratic number fields*, *Journal of Mathematical Analysis and Applications*, **418** (2014), no. 1, 100–107.

8. *Moments of products of automorphic L -functions* (with M. B. Milinovich), *Journal of Number Theory*, **139** (2014), 175–204.

PUBLICATIONS WITH UNDERGRADUATE CO-AUTHORS

1. *Benford behavior of generalized Zeckendorf decompositions* (with A. Best, P. Dynes, X. Edelsbrunner, B. McDonald, S. J. Miller, and M. Weinstein), *Combinatorial and Additive Number Theory II: CANT*, New York, NY, USA, 2015 and 2016, Springer, New York, 2017.
2. *Gaussian distribution of the number of summands in generalized Zeckendorf decompositions*, (with A. Best, P. Dynes, X. Edelsbrunner, B. McDonald, S. J. Miller, K. Tor, and M. Weinstein), *INTEGERS* **16** (2016), #A6
3. *Gaps between zeros of $GL(2)$ L -functions*, (with O. Barrett, B. McDonald, S. J. Miller, P. Ryan, and K. Winsor), *Journal of Mathematical Analysis and Applications*, **429** (2015), 204–232.
4. *Gaussian behavior of the number of summands in Zeckendorf decompositions in small intervals*, (with A. Best, P. Dynes, X. Edelsbrunner, B. McDonald, S. J. Miller, K. Tor, and M. Weinstein), *Fibonacci Quarterly* **52** (2014), no. 5, 35–46.
5. *Benford behavior of Zeckendorf decompositions*, (with A. Best, P. Dynes, X. Edelsbrunner, B. McDonald, S. J. Miller, K. Tor, and M. Weinstein), *Fibonacci Quarterly* **52** (2014), no. 5, 47–53.

BOOK CONTRIBUTIONS

1. *From Quantum Systems to L -Functions: Pair Correlation Statistics and Beyond*, (with O. Barrett, F. W. K. Firk, and S. J. Miller), *Open Problems in Mathematics* (editors John Nash Jr. and Michael Th. Rassias), Springer-Verlag (2016).
2. *Some Results in the Theory of Low-lying Zeros*, (with B. Mackall, S. J. Miller, C. Rapti, and K. Winsor), in *Families of automorphic forms and the trace formula* (editors Werner Müller, Sug Woo Shin, and Nicolas Templier), *Simons Symposia Series*, Springer-Verlag.
3. *Benfordness of the Cauchy Distribution and Generalizations*, (with X. Edelsbrunner, K. Huan, B. Mackall, J. Powell, and M. Weinstein), Section 3.6, an appendix to *Theory and Applications of Benford's Law*, (S. J. Miller, editor), Princeton University Press, 2015.

GRANTS

- Carleton College Hewlett Mellon Fellowship, 2020
- Carleton College Curriculum Development Grant, 2020 (\$1,200)
- National Science Foundation Standard Grant DMS-1902193, 2019–2021 (\$74,980 – PI)
- National Science Foundation FRG Grant DMS-1854398, 2019–2021 (Senior Scientist Consultant)
- American Mathematical Society (AMS) Simons travel grant 2019–2020 (\$2,000), declined
- Carleton College Curriculum Innovation Grant, 2019 (\$1,700)
- American Mathematical Society (AMS) Simons travel grant 2018–2019 (\$2,000)
- National Security Agency (NSA) conference grant 2015–2017, re:boot Number Theory 2016, Duke University (c. \$ 21,000 – Co-PI)
- Association for Women in Mathematics (AWM)/ National Science Foundation (NSF) travel grant DMS-1153905, May 2014 (\$2,350)
- Graduate Assistance in Areas of National Need (GAANN) summer research grants, 2010, 2012, 2013, University of Mississippi

EXTENDED FUNDED VISITS

- Max Planck Institute of Mathematics (MPIM), July 1 – July 31, 2018
- Mathematical Sciences Research Institute (MSRI), January 17 – May 26, 2017

AWARDS

- US Junior Oberwolfach Fellow, 2019
- Project NEXt Fellow – Silver'19 cohort, Mathematical Association of America
- University of Mississippi Class Marshal – May 2014
- Graduate Instructor Excellence in Teaching Award – 2012–2013
- Graduate Student Achievement Award in Mathematics – Spring 2013
- GAANN fellowship – August 2009 – May 2014, funded by the US Department of Education

TEACHING EXPERIENCE

- **Carleton College**, Northfield, Minnesota
 - Introduction to Calculus (Math 111), Fall 2018, Winter 2019, Fall 2019, Fall 2020
 - Calculus 2 (Math 120), Fall 2019, Winter 2020
 - Calculus 3 (Math 210), Winter 2020
 - Functions of a Complex Variable (Math 261), Spring 2019
 - Elementary Theory of Numbers (Math 312), Spring 2019
 - Real Analysis I (Math 321), Fall 2020
 - Complex Analysis (Math 361), Spring 2020
- **Duke University**, Durham, North Carolina
 - Linear Algebra and Applications (Math 221), Fall 2015, Fall 2016, Fall 2017
 - Elementary Number Theory Seminar (Math 305s), Spring 2016, Spring 2018
- **North Dakota State University**, Fargo, North Dakota
 - Calculus I (Math 165), Fall 2014, Spring 2015
 - Elementary Number Theory (Math 472/672), Spring 2015
- **University of Mississippi**, Oxford, Mississippi
 - Trigonometry (Math 123), Spring 2012, Spring 2013
 - Precalculus (Math 125), Fall 2010, Spring 2011, Fall 2011
 - Business calculus I (Math 267), Fall 2009
 - Calculus I (Math 261), Fall 2013, Fall 2012
 - Introduction to analytic number theory (Math 597), co-instructor, Spring 2014

RESEARCH TALKS

- VaNTAGe (virtual seminar on open conjectures in number theory and arithmetic geometry) – February 2020
- AMS Special Session on Analytic Theory of Automorphic Forms and L-Functions, JMM, Denver – January 2020
- Analytic Number Theory Workshop, MFO, Oberwolfach Research Institute for Mathematics– November 2019
- NSF-CBMS Conference: L -functions and Multiplicative Number Theory, University of Mississippi – May 2019
- Analytic Aspects of Automorphic Forms, Université de Lille – April 2019
- Value Distribution of Zeta and L-functions and Related Topics, RIKEN Institute – March 2019
- CMS Special Session, CMS Winter Meeting, Vancouver – December 2018
- New Trends in Analytic Number Theory, LMS-CMI Research School, University of Exeter – August 2018
- Number Theory Seminar, MPIM – July 2018
- PLeaSANTS, MPIM – July 2018
- Algebra and Number Theory Seminar, University of Cologne – July 2018
- L -functions: Open Questions and Current Methods, Summer school on L -functions, Hausdorff Center for Mathematics – June 2018
- Department Colloquium, Oberlin College – November 2017
- Algebra, Geometry, and Number Theory Seminar, Tufts University – November 2017
- Department Colloquium, Elon University – October 2017
- Algebraic Geometry and Number Theory Seminar, Rice University – April 2017
- AMS Special Session, AMS Sectional Meeting Washington State University – March 2017
- Connections for Women, Analytic Number Theory Workshop, MSRI – February 2017
- AMS Special Session on Analytic number theory and arithmetic, JMM – January 2017
- Number Theory Seminar, University of South Carolina – November 2016
- Bridging Theoretical and Applied Mathematics REU, Winthrop University – June 2016
- WADE Into Research REU, Wake Forest University – June 2016
- Number Theory Seminar, University of Illinois Urbana-Champaign – April 2016
- Department Colloquium, Wake Forest University – April 2016
- Computational aspects of L -functions, ICERM – November 2015
- Elementary, analytic, and algorithmic number theory: Research inspired by the mathematics of Carl Pomerance, University of Georgia – June 2015
- AMS Special Session on Analytic Methods in Elementary Number Theory, AMS Spring Southeastern Sectional Meeting, University of Alabama – March 2015
- UNC-Duke Number Theory Seminar, Duke University – January 2015
- Department Colloquium, Williams College – January 2015
- Exciting New Faces in Analytic Number Theory (ENFANT), Hausdorff Center for Mathematics, Bonn – July 2014
- Department Colloquium, Williams College – June 2014

- Department Colloquium, Wofford College – April 2014
- AMS Special Session on Modern Methods in Analytic Number Theory, AMS Sectional Meeting, University of Mississippi – March 2013

PEDAGOGICAL TALKS

- *Understanding X: Contextualizing Formulas*, Faculty Development Workshop Series, Center for Excellence in Teaching and Learning, University of Mississippi, November 2013
- *Understanding X: Contextualizing Formulas*, Graduate Student Seminar, Center for Excellence in Teaching and Learning, University of Mississippi, November 2013
- *Engaging Student Learners*, Graduate Instructor Workshop, Center for Excellence in Teaching and Learning, University of Mississippi, August 2013

TRAINING AND WORKSHOP PARTICIPATION

- Mental Health First Aid Training – Carleton College, May 2019
- Structuring the Classroom for Inclusive Teaching – CIT, Duke University, October 2016
- Center for Instructional Technology (CIT) Showcase – Duke University, October 2016
 - *Critical Race Theory for Improving College Courses*, workshop
 - *Ideas for Great Group Work*, workshop
 - *Improve Your Teaching with Meaningful Student Feedback*, workshop
- P.R.I.D.E Training – Center for Sexual and Gender Diversity, Duke University, April 2016

PROFESSIONAL SERVICE

- Referee – Algebra & Number Theory, ANTS, American Mathematical Monthly, INTEGERS, International Mathematical Research Notices, International Journal of Number Theory, Journal of the European Mathematical Society, Journal of Number Theory, Quarterly Journal of Mathematics
- Reviewer – MathSciNet
- Co-organizer (with A. Malik and G. Martin), MCA Special Session *Advances in algebraic and analytic number theory*, 2017 MCA, Montreal, Quebec
- Co-director (with A. Alvarado, J. Fuselier, H. Hahn, and L. Pierce), re:boot Number Theory 2017, Duke University, June 6-9, 2017 www.math.duke.edu/~pierce/Reboot2016.shtml
- Co-organizer (with M. Nastasescu), MAA Invited Paper Session *L-functions and other animals*, 2017 JMM in Atlanta, Georgia.
- Co-director (with A. Bucur, H. Hahn, P. Paaajanen, and L. Pierce), re:boot Number Theory 2016, Duke University, March 17-20, 2016 www.math.duke.edu/~pierce/Reboot2016.shtml

INSTITUTIONAL SERVICE

- Department of Mathematics & Statistics Colloquium – organizer, Fall 2020 - present
- Campus Recreation Advisory Committee – faculty member, Fall 2019 - present
- FOCUS – colloquium speaker, Fall 2019
- SWiMS+ (Society for Women in Mathematics & Statistics) – faculty co-organizer, 2018-present - organization for female and nonbinary students and faculty at Carleton interested in mathematics and statistics.
- Math Skills Center Tutor Training – faculty liaison (2019-2020)

- Inside Carleton Alumni Magazine *For the Love of Teaching*, Spring 2019 – cover
- NUMS (Northfield Undergraduate Mathematics Symposium) – faculty co-organizer, Fall 2018, Fall 2019, Fall 2020
 - an annual event sponsored jointly by Carleton and St. Olaf
- Graduate School Panel – invited panelist, Carleton College, Fall 2018
- ONTO-Math – committee member, Duke University, Fall 2016 - mathematics first-year curriculum development for students entering without AP credit
- SWIM (Summer Workshop in Mathematics) – faculty advisory committee, Duke University, June 2016
 - workshop for female high school students www.math.duke.edu/SWIM/SWIM2016/
- Graduate Student Seminar, Department of Mathematics, U. of Mississippi – founder and organizer
- Allies @ Ole Miss – Ally, Fall 2012 – Spring 2014
 - member of network of faculty who are visibly supportive of students from the LGBTQ+ community

OUTREACH

- Letters to a Pre-Scientist – Fall 2019 - present
- Science Question from a Toddler, fivethirtyeight.com – October 2017
 - consultant for the article *What Would Happen If There Were No Number 6?*
 - www.fivethirtyeight.com/features/what-would-happen-if-there-were-no-number-6
- SWIM (Summer Workshop in Mathematics), Duke University – June 2017
 - course instructor for workshop for female high school students www.math.duke.edu/SWIM/SWIM2017
- Southeastern Conference for Undergraduate Women in Mathematics, Duke University – Nov. 2016
 - invited speaker for introduction lecture and activity “How to Conference Like a Pro(fessor)” designed to encourage and facilitate networking among the conference’s undergraduate participants
- Dinner for 8, Duke University – October 2016
 - invited by a current student to co-host a dinner with members of the UNC-Duke University Robertson Scholar Program to share my experiences in academia
- Harkness Series Lecture, Spartanburg Day School – October 2016
 - lecture on primes given to upper school students at Spartanburg Day School in Spartanburg, SC
- SWIM Lecture, Duke University – June 2016
 - lecture on primes given to female rising high school students at SWIM 2016 held at Duke University
- NDSU Math Department Outreach Activity – April 2015
 - visited a local elementary school to demonstrate tic-tac-toe on a torus
- Nebraska Conference for Undergraduate Women in Mathematics – January 2012
 - invited graduate panelist for discussions and break-out sessions
- Gear Up Mississippi Summer College Lecture – July 2009, July 2010
 - lecture on fractals with hands-on activities demonstrating connection between mathematics and art

PROFESSIONAL ORGANIZATION MEMBERSHIP

- American Mathematical Society
- Association for Women in Mathematics
- National Association of Mathematicians
- Math Alliance
- Mathematical Association of America