Caroline L. Turnage-Butterbaugh

Department of Mathematics and Statistics
Carleton College
Northfield, MN 57707 USA

+1 (507) 222-4785
cturnageb@carleton.edu
http://apps.carleton.edu/people/cturnageb/

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. *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), submitted, preprint available at https://arxiv.org/abs/1902.02008

Publications

1. *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.

2. *Extremal primes of elliptic curves without complex multiplication* (with C. David, A. Gafni, A. Malik, and N. Prabhu), Proceedings of the America Mathematics Society **148** (2020), no. 3, 929–943.

3. *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.

4. *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.

5. *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).

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.

6. *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.

7. *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.

EXTENDED FUNDED VISITS

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

GRANTS

- National Science Foundation Standard Grant DMS-1902193, 2019–2021 ($74,980 – PI)
- National Science Foundation FRG Grant DMS-1854398, 2019–2021 ($473,094 – Senior Scientist)
- 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 2914 ($2,350)
- Graduate Assistance in Areas of National Need (GAANN) summer research grants, 2010, 2012, 2013, University of Mississippi

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. Paajanen, and L. Pierce), re:boot Number Theory 2016, Duke University, March 17-20, 2016   www.math.duke.edu/~pierce/Reboot2016.shtml

Institutional Service

- 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
  - 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