

# Brandon Hanson

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## Citizenship

Canadian

## Education

Ph.D. Mathematics. University of Toronto (under Prof. J. B. Friedlander), 2015. Thesis: *Character sum estimates in finite fields and applications*.

M.Sc. Mathematics. University of Toronto, 2010.

B.Math. Computer Mathematics, *Highest Honours*. Carleton University, 2009.

## Positions

Assistant Professor. The University of Maine, 2021-Present.

Limited Term Assistant Professor. The University of Georgia, 2018-2021.

Chowla Research Fellow. The Pennsylvania State University, 2015-2018.

Visitor - Long program "Thematic Program on Unlikely Intersections, Heights, and Efficient Congruencing". Fields Institute, January-April 2017.

Research member - Long program "Algebraic Techniques for Combinatorial and Computational Geometry". Institute for Pure and Applied Mathematics at UCLA, March-June 2014.

## Research

### *Fields of Research Interest*

Number theory, combinatorics, harmonic analysis.

## Honors, Awards, & Fellowships

NSF Grant 2001622 - *Arithmetic structure and distribution*. \$95,398, 2020-2023.

AMS-Simons Travel Grant. \$4000, 2018-2020.

## Publications

1. B. Hanson, M. Rudnev, I. Shkredov and D. Zhelezov, *The sum-product problem for integers with few prime factors*. Submitted. arXiv:2305.04038
2. B. Hanson, O. Roche-Newton and S. Senger, *Convexity, Superquadratic Growth, and Dot Products*. J. Lond. Math. Soc. (2) 107 (2023), no. 5, 1900-1923.

3. P. Bradshaw, B. Hanson and M. Rudnev, *Higher convexity and iterated second moment estimates*. Electron. J. Combin. 29 (2022), no. 3, Paper No. 3.6.
4. B. Hanson and G. Petridis, *A question of Bukh on sums of dilates*. Discrete Anal. 2021, Paper No. 13.
5. B. Hanson, O. Roche-Newton and M. Rudnev, *Higher convexity and iterated sumsets*. Combinatorica 42 (2022), no. 1, 71-85.
6. B. Hanson, *Littlewood's problem for sets of integers with multidimensional structure*. International Mathematics Research Notices, Volume 2021, Issue 21, November 2021, Pages 16734–16748.
7. B. Hanson and G. Petridis, *Refined Estimates Concerning Sumsets Contained in the Roots of Unity*. Proc. Lond. Math. Soc.(3) 121(2), 287-292, 2020.
8. B. Hanson, *Long regularly-spaced and convex sequences in dense sets of integers*. J. Combin. Theory Ser. A 180 (2021), Paper No. 105393.
9. B. Hanson, O. Roche-Newton and D. Zhelezov, *On iterated product sets with shifts II*. Algebra Number Theory 14 (2020), no. 8, 2239–2260.
10. B. Hanson, O. Roche-Newton and D. Zhelezov, *On iterated product sets with shifts*. Mathematika 65 (2019), no. 4, 831-850.
11. B. Hanson, *Additive Correlation and the Inverse Problem for the Large Sieve*. Mathematical Proceedings of the Cambridge Philosophical Society, 2018.
12. B. Hanson and A. Zaman, *The density of numbers represented by diagonal forms of large degree*. Mathematika 64 (2018), no. 2, 542-550.
13. B. Hanson and R.C. Vaughan, *Density of Positive Diagonal Binary Quadratic Forms*. Acta Arith. 193 (2020), no. 1, 1-48.
14. B. Hanson, *The Additive Structure of Cartesian Products Spanning Few Distinct Distances*. Combinatorica 38 (2018), no. 5, 1095-1100.
15. B. Hanson, R.C. Vaughan and R. Zhang, *The least number with prescribed Legendre symbols and representation by binary quadratic forms of small discriminant*. J. Number Theory 179 (2017), 3-16.
16. B. Hanson, *Estimates for character sums with various convolutions*. Acta Arith. 179 (2017), no. 2, 133-146.
17. B. Hanson, B. Lund and O. Roche-Newton, *On distinct perpendicular bisectors and pinned distances in finite fields*. Finite Fields Appl. 37 (2016), 240-264.
18. B. Hanson. *Character sums over Bohr sets*. Canad. Math. Bull. 58 (2015), no. 4, 774-786.
19. B. Hanson. *Capturing forms in dense subsets of finite fields*. Acta Arith. 160 (2013), 277-284.
20. B. Hanson, D. Panario and D. Thomson. *Swan-like results for binomials and trinomials over finite fields of odd characteristic*. Designs, Codes and Cryptography, 61(3) (2011), 273-283.

## Teaching

### *University of Maine*

Introduction to abstract math, Vector analysis, Calculus 3, Introduction to Real Analysis 1 and 2, Real Analysis 1 and 2 (graduate), Introduction to Statistical Inference.

*University of Georgia*

Precalculus, Calculus I, short graduate course on Fourier analysis with applications to number theory, graduate reading course on the polynomial method.

*Pennsylvania State University World Campus*

Techniques of calculus.

*Pennsylvania State University*

Calculus II, Calculus III, Introduction to real analysis.

*Teaching Assistant, University of Toronto*

Linear and abstract algebra, calculus and ordinary differential equations, real and complex analysis, number theory, combinatorics.

## Service

Referee for *Mathematika*, *Journal of Number Theory*, *Journal of Combinatorial Theory Series A*, *Annals of Combinatorics*, *Proceedings of the AMS*, *Indiana University Mathematics Journal*.

Section co-organizer for 2020 Winter Meeting of the Canadian Mathematical Society.

## Seminar and Conference Talks

Sum-product with few prime factors.

JMM 2023, January 2023.

GATech - AMS Southeast Sectional meeting on discrete analysis, March 2023.

GATech/Emory joint discrete analysis seminar, November 2023.

Higher convexity, expanders, and dot products.

Purdue (PANTHA Seminar), December 2021.

UBC Discrete math seminar, March 2022.

SIAM Discrete Math minisymposium, June 2022.

Higher convexity and iterated sumsets - further results.

New York Number Theory Seminar, March 2021.

George Mason University CAGS, March 2021.

Sectional meeting of the AMS, April 2021.

75<sup>th</sup>+1 Anniversary of the CMS, June 2021.

Higher convexity and iterated sumsets.

Mississippi/KSU number theory seminar, October 2020.

Webinar in additive combinatorics, November 2020.

The cardinality of  $A + 2 \cdot A$ .

Online AMS sectional meeting, October 2020.

Winter meeting of the CMS, December 2020.

Regular and convex subsequences in dense sets of integers.

Second Vietnam Workshop on Graph Theory and Discrete Geometry, January 2019.

Multiplicatively structured sets, shifted.

AIM program on Additive Combinatorics, August 2018.

UGA Number Theory Seminar, September 2018.

Additive correlation and the inverse problem for the large sieve.

MIT Combinatorics Seminar, December 2017.

Penn State Algebra and Number Theory Seminar, September 2017.

The density of integers not represented by diagonal forms of large degree.

Combinatorial and Additive Number Theory (CANT), May 2017.

Towson University, May 2017.

Representation by binary quadratic Forms in short intervals.

Fields Institute, February 2017.

Sums of squares and combinatorial geometry

Conference on Analytic Number Theory, Oberwolfach, November 2016.

Interactions between combinatorial geometry and additive combinatorics

Penn State Algebra and Number Theory Seminar, September 2016.

UGA Combinatorics Seminar, September 2016.

The additive structure of squares.

Rochester Combinatorics Seminar, April 2016.

Character sums with various convolutions.

UGA Number Theory Seminar, April 2015.

Georgia Tech Combinatorics Seminar, April 2015.

PSU Number Theory Seminar, March 2015.

Winter Meeting of the Canadian Mathematical Society, Section Harmonic Analysis and Diophantine Equations, December 2015.

IPAM Reunion Conference, December 2015.

Character sums on Bohr sets - IPAM Algebraic Techniques for Combinatorial and Computational Geometry, Seminar series, June 2014.

Multiplicative character sums and the Littlewood problem - IPAM Algebraic Techniques for Combinatorial and Computational Geometry, Culminating workshop, June 2014.

Capturing forms in dense subsets of finite fields - Number Theory Satellite Session, Winter meeting of the CMS, Dec. 2012.

## Miscellaneous

*Spoken Languages:* English, French.

*Programming Languages:* C++, Java, PHP, JavaScript, Sage.