Nathaniel Stapleton

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Education

- Ph.D. Mathematics, University of Illinois Urbana-Champaign, Advisor: Charles Rezk, May 2011.
- B.S. Mathematics, Wheaton College, IL 2004.
- B.S. Computer Science, Wheaton College, IL 2004.
- Budapest Semester in Mathematics, Fall 2003.

Employment

- Ralph E. and Norma L. Edwards Research Professor, University of Kentucky, July 2023 - present
- Associate Professor, University of Kentucky, July 2021 - present
- Assistant Professor, University of Kentucky, August 2017 - July 2021
- Postdoctoral Fellow, University of Regensburg, July 2016 - December 2017
- Postdoctoral Fellow, Max Planck Institute for Mathematics, August 2014 - August 2016
- CLE Moore Instructor, MIT, 2011 - 2014
- Guest, Max Planck Institute for Mathematics, August 2013, February 2020, May 2022

Research Interests

- Stable homotopy theory: chromatic and equivariant stable homotopy theory
- Formal algebraic geometry: formal groups and p-divisible groups
- Applications of algebraic and arithmetic geometry to stable homotopy theory
- The relationship between field theories and chromatic homotopy theory

Papers and Publications

- "On the rationalization of the $K(n)$-local sphere", with Tobias Barthel, Tomer Schlank, and Jared Weinstein, arXiv:2402.00960.
- "The homotopy of the KU_G-local equivariant sphere spectrum", with Tanner Carawan, Rebecca Field, Bert Guillou, and David Mehrle, accepted for publication in *J. Homotopy Relat. Struct.*.
- "On the KU_G-local equivariant sphere", with Peter Bonventre and Bert Guillou, arXiv:2204.03797.

- "Evaluation maps and transfers for free loop spaces II", with Sune Precht Reeh and Tomer Schlank, arXiv:2109.13988.
- "Evaluation maps and transfers for free loop spaces I", with Sune Precht Reeh and Tomer Schlank, arxiv:2108.06541.
- "Power operations in the Stolz–Teichner program", with Tobias Barthel and Daniel Berwick-Evans, *Geom. and Topol.*, 26(4):1773-1848, 2022.
- "Transfer ideals and torsion in the Morava E-theory of abelian groups", with Tobias Barthel, *J. Homotopy Relat. Struct.*, 15(2):369-375, 2020.
- "Additive power operations in equivariant cohomology", with Peter Bonventre and Bert Guillou, arXiv:2001.11078.
- "Level structures on p-divisble groups from the Morava E-theory of abelian groups", with Zhen Huan, accepted for publication in *Math. Z.*, 2023.
- "Monochromatic homotopy theory is asymptotically algebraic", with Tobias Barthel and Tomer Schlank, *Adv. Math.*, 393:Paper No. 107999, 44, 2021.
- "Lubin-Tate theory, character theory, and power operations", *Handbook of homotopy theory*, CRC Press/Chapman and Hall Handbooks in Mathematics, pp. 891-930, 2019.
- "Chromatic homotopy theory is asymptotically algebraic", with Tobias Barthel and Tomer Schlank, *Invent. Math.*, 2020.
- "The Balmer spectrum of the equivariant homotopy category of a finite abelian group", with Tobias Barthel, Markus Hausmann, Niko Naumann, Thomas Nikolaus, and Justin Noel, *Invent. Math.*, 216(1):215-240, 2019.
- "Excellent rings in transchromatic homotopy theory", with Tobias Barthel, *Homology, Homotopy Appl.* 20 (2018), *no. 1*, 209-218.
- "A formula for p-completion by way of the Segal conjecture", with Sune Precht-Reeh and Tomer Schlank, arXiv:1704.00271, accepted for publication in *Topol. Appl.*, 2022.
- "A canonical lift of Frobenius in Morava E-theory", *Homology, Homotopy Appl.*, 21(1):341-350, 2019.
- "Brown–Peterson cohomology from Morava E-theory", with Tobias Barthel. *Comp. Math.*, 153(4): 780-819, 2017. With an appendix by Jeremy Hahn.
- "The character of the total power operation", with Tobias Barthel. *Geom. and Topol.*, 21(1):385-440, 2017.
- "Centralizers in good groups are good", with Tobias Barthel, *Algebr. Geom. Topol.*, 16(3):1453-1472, 2016.
- "A transchromatic proof of Strickland's theorem", with Tomer Schlank, *Adv. Math.*, 285 : 1415 - 1447, 2015.
- "On the ring of tmf cooperations at the prime 2", with Mark Behrens, Kyle Ormsby, and Vesna Stojanoska, *J. Top.*, 12(2), 577-657, 2019.
- "Singular cohomology from supersymmetric field theories", with Christopher Schommer-Pries, *Adv. Math.*, 390 : Paper No. 107944, 52, 2021.

- "A relative Lubin-Tate theorem via meromorphic formal geometry", with Aaron Mazel-Gee, Eric Peterson, *Algebr. Geom. Topol.*, 15(4):2239-2268, 2015.
- "Subgroups of p-divisible groups and centralizers in symmetric groups", *Trans. Amer. Math. Soc.*, 367(5):3733-3757, 2015.
- "Transchromatic twisted character maps", *J. Homotopy Rel. Struct.*, 10(1):29-61, 2015.
- "Transchromatic generalized character maps". *Algebr. Geom. Topol.*, 13(1):171 - 203, 2013.

Grants and Awards

- NSF grant, Rational and equivariant phenomena in chromatic homotopy theory, $297,584, 2023-2026.
- Simons Travel Support for Mathematicians, $42,000, 2023-2028.
- Sloan Research Fellow, $75,000, 2021-2025.
- NSF conference grant for The 2nd Transatlantic Transchromatic Homotopy Theory conference, $15,000.
- The 2nd Transatlantic Transchromatic Homotopy Theory conference, €20,000.
- BSF grant, New Tools in Chromatic Homotopy Theory, joint with Tomer Schlank at Hebrew University in Jerusalem, $140,000, 2019-2023.
- NSF grant, New Tools in Chromatic Homotopy Theory, $168,544, 2019-2023.
- Simons Collaboration grant, $24,000, terminated with acceptance of NSF grant above.
- Transatlantic transchromatic homotopy theory conference, €35,000.
- NSF grant, Transchromatic Homotopy Theory, $134,977, 2014-2017, terminated in 2014 with move to MPIM.
- AMS-Simons travel grant, $4000, 2014-2016
- NSF Vigre fellowship - University of Illinois, Fall 2004 and Fall 2005.
- Angeline J. Brandt Memorial Award for Excellence in Mathematics, Wheaton College, 2004.

Students

- PhD students: Lewis Dominguez, Millie Rose, Nathan Cornelius.
- Masters Student (graduated): Rafael Rojas. Finished Spring 2019. Masters project: Compactness, invertibility, and dualizability in pleasant symmetric monoidal categories.
- Masters Student (graduated): Janet Huffman. Finished Spring 2022. Master project: Idempotents and units in Burnside rings.
- Masters Student (graduated): Shahzad Kalloo. Finished Spring 2023. Master project: Complex oriented cohomology theories and the language of stacks.

Teaching

- UKY Algebraic Topology, MA654, Fall 2023.
- UKY Business Calculus (large lecture), MA123, Fall 2023.
- UKY Number Theory, MA261, Fall 2022.
- UKY Topology 1, MA551, Fall 2022.
- UKY Infinity categories, MA752, Spring 2022.
- UKY Number Theory, MA261 Spring 2022.
- UKY Topology 1, MA551, Fall 2021.
- UKY Topology 1, MA551, Fall 2020.
- UKY Analysis, MA 471, Fall 2020.
- UKY Topology 1, MA551, Fall 2019.
- UKY Calculus 1 (large lecture), MA113, Fall 2019.
- UKY Calculus 1 (large lecture), MA113, Fall 2019.
- UKY Homological Algebra from a Homotopical Viewpoint, MA752, Spring 2019.
- UKY Multivariable Calculus (large lecture), MA213, Spring 2019.
- UKY Topology 1, MA551, Fall 2018.
- UKY Number Theory, MA261 Spring 2018.
- UKY Matrix Algebra, MA322 Spring 2018.
- MIT Differential Equations, Course 18.03 Spring 2014.
- MIT Project Lab in Mathematics, Course 18.821 Spring 2013.
- MIT Accelerated Calculus, Course 18.01a, 18.02a Fall 2012, Fall 2013.
- MIT Multivariable Calculus, Course 18.02, Fall 2011, Spring 2012.
- UIUC Calculus 2 Active Learning Instructor, Spring 2008.
- UIUC Finite Mathematics Instructor, Fall 2007.
- UIUC A Mathematical World Instructor, Fall 2006.
- UIUC Calculus 2 Active Learning Instructor, Spring 2006.
- UIUC Calculus 2 Teaching Assistant, Spring 2005.

Service

- UKY Bourbon seminar, Leader, Fall 2022 - present.
- Member of graduate student admissions committee, Spring 2022, Spring 2023, Spring 2024.
- Member of hiring committee, Fall 2022.
- Group coleader (with Bert Guillou), Virginia Collaborative Workshop in Homotopy Theory, August 2022.
- Group coleader (with Lewis Dominguez), University of Kentucky MathLab, Spring 2022 - Summer 2022.
- Member of hiring plan committee, Spring 2022.
- Member of department head search committee, Fall 2021.
- Chair of postdoc hiring committee, 2021-2022
- Member of doctoral committee for: Shane Clark, Ankur Das, Amartya Saha, Ang Li, Carissa Slone, Justin Barhite.
- Organizer for Kentucky Condensed Mathematics learning seminar, Spring 2021.
- Organizer for the second Transatlantic Transchromatic warm-up conference, Fall 2021.
- Organizer for Transatlantic Transchromatic warm-up conference, Fall 2020.
- Referee for several journals including “Advances in Mathematics", “Geometry and Topology", and “Journal of Topology".
- NSF review panelist (multiple times)
- CUMT mentor at the University of Kentucky, Fall 2019.
- Organizer for The 2nd Transatlantic Transchromatic Homotopy Theory Conference, Summer 2020.
- Elected member of the UKy mathematics department executive committee, Fall 2019 - present.
- Reviewer for Masters Thesis from Hebrew University in Jerusalem.
- Organizer, University of Kentucky Topology Seminar, Fall 2018 - Fall 2021.
- Group leader, University of Kentucky MathLab, Spring 2018 - Spring 2019 (including Summer 2018).
- Organizer for Midwest Topology Seminar, Fall 2018.
- Organizer for International Workshop on Algebraic Topology, Summer 2018.
- Organizer for the Transatlantic Transchromatic Homotopy Theory Conference, Summer 2017.
- Felix Klein lectures recitation leader, Summer 2015.
- Chromatic homotopy theory working seminar, Organizer, Summer 2015.
- MIT E-theory Seminar, Organizer, Spring 2013.
- Freshman Advisor, 2012-2013.
- UROP Mentor, 2012-2013.
- Course Administrator, Fall 2012, 2013.

Selected Conferences Attended

- Speaker at Midwest topology seminar, UIUC, October 2023.
- Oberwolfach homotopy theory conference, August 2023.
- The second transchromatic homotopy theory conference, August 2023.
- A panorama of homotopy theory - a conference in honor of Mike Hopkins, July 2023.
- Speaker at Homotopy theory in honor of Paul Goerss, Northwestern, April 2023.
- Midwest Topology Seminar (Mayday 2019), University of Chicago, October 2019.
- Primary Speaker (six talks) at Caesarea Workshop, Caesarea, Israel, June 2019.
- Midwest Topology Seminar, UIUC, February 2019.
- Speaker at Chromatic Homotopy Theory and Derived Algebraic Geometry, Newton Institute, Cambridge, England, September 2018.
- Organizer of Midwest Topology Seminar, University of Kentucky, September 2018.
- Speaker & Organizer at International Workshop on Algebraic Topology, Shenzhen, China, June 2018.
- Speaker at Chromatic Homotopy Theory: Journey to the Frontier, Boulder, CO, May 2018.
- Speaker at Special Session on Recent Progress and New Directions in Homotopy Theory, AMS Sectional, Vanderbilt, April 2018.
- Speaker at Special Session on Homotopy Theory, AMS Sectional, Columbus OH, March 2018.
- Speaker at Midwest Topology Conference, Northwestern, March 2018.
- Speaker at Lloyd Roeling Topology Conference, UL Lafayette, November 2017.
- Organizer of The Transatlantic Transchromatic Homotopy Theory Conference, Regensburg, June 2017.
- Invertibility and Duality in Derived Algebraic Geometry and Homotopy Theory, Regensburg, April 2017.
- Oberwolfach Topologie Conference, July 2016.
- Speaker at 24th NRW topology meeting, Ruhr University Bochum, Fall 2015.
- Speaker at Workshop on Interactions between Arithmetic and Homotopy, Imperial College, Fall 2015.
- Hausdorff Institute Homotopy theory, manifolds, and field theories, Summer 2015.
- Oberwolfach Homotopy theory Conference, March 2015.
- Oberwolfach Topologie Conference, September 2014.
- Modular Invariants in Topology and Analysis, Regensburg, September 2014.
- MSRI Introductory Workshop: Algebraic Topology, January 2014.
- Talbot Seminar, Spring 2013.

- Speaker at Equivariant, Chromatic, and Motivic Homotopy Theory, Northwestern University, March 2013.
- Speaker at Strings and Automorphic Forms in Algebraic Topology, RUB Bochum, August 2012.
- Conference on Topology and Field Theories (Postdoc and Graduate Student Workshop), Notre Dame, June 2012.
- Workshop: Kervaire Invariant, MSRI, October 2010.
- Conference on Homotopy Theory and Derived Algebraic Geometry, Fields Insitute, August 2010.
- MTN/UIUC p-Divisible Groups Workshop, UIUC, June 2009.
- Conference and Workshop on Topological Field Theories, Northwestern, May 2009.
- Homotopical Group Theory and Topological Algebraic Geometry, MPIM, May 2008.
- Thematic Progam on Geometric Applications of Homotopy Theory, Fields Institute, May 2007.
- Graduate Student Topology and Geometry Conference, University of Michigan, April 2010; University of Wisconsin Madison, April 2009; UIUC, April 2008 - co-organizer; University of Chicago, April 2007.

Selected Talks

- On the image of the total power operation for Burnside rings, Notre Dame topology seminar, Spring 2024.
- On the rationalization of the $K(n)$-local sphere, Princeton algebraic topology seminar, Spring 2024.
- On the rationalization of the $K(n)$-local sphere, Johns Hopkins topology seminar, Spring 2024.
- On the rationalization of the $K(n)$-local sphere, Midwest topology seminar, UIUC, Fall 2023.
- A universal relation between multiplicative and additive power operations, Homotopy theory in honor of Paul Goerss, Spring 2023.
- On the KU_G-local equivariant sphere, Mid-South algebraic topology and geometry workshop, Summer 2022.
- On the KU_G-local equivariant sphere, MPIM topology seminar, Spring 2022.
- Transfers, free loops, and evaluation maps, UCLA topology seminar, Spring 2021.
- Transfers, free loops, and evaluation maps, Chicago topology seminar, Spring 2021.
- Transfers, free loops, and evaluation maps, Jerusalem international topology seminar, Spring 2021.
- On the localization of the equivariant sphere with respect to equivariant K-theory, Rochester topology seminar, Spring 2021.
- Additive power operations in equivariant cohomology, MPIM topology seminar, Spring 2020.
- Unstable to stable: loops and evaluation maps, Kentucky topology seminar, Spring 2020.
- Symmetric monoidal categories as op-fibrations, Kentucky topology seminar, Fall 2019.

- An invitation to Morava's extraordinary E-theories, Kentucky topology seminar, Fall 2019.
- Lecture series on Chromatic Homotopy Theory, Power Operations, and Character Theory (6 talks), Caesarea Workshop, Summer 2019.
- Classifying spectra of finite groups and chromatic homotopy theory, UIUC topology seminar, Spring 2018.
- Chromatic musings around the Segal conjecture, Kentucky topology seminar, Spring 2018.
- Classifying spectra of finite groups and chromatic homotopy theory, MIT topology seminar, Fall 2018.
- The Adams spectral sequence: an overview, Kentucky topology seminar, Fall 2018.
- A noncommutative ring structure on the E-cohomology of the square of a group, IUPUI topology seminar, Fall 2018.
- Transchromatic homotopy theory, Chromatic Homotopy Theory and Derived Algebraic Geometry, Newton Institute, Cambridge, England, Fall 2018.
- Chromatic homotopy theory is asymptotically algebraic, International Workshop on Algebraic Topology, Shenzhen, China, Summer 2018.
- Chromatic homotopy theory is asymptotically algebraic, Chromatic Homotopy Theory: Journey to the Frontier, Boulder, CO, Summer 2018.
- The character of the total power operation, University of Virginia topology seminar, Spring 2018.
- A formula for p-completion by way of the Segal conjecture, AMS sectional, Nashville, Spring 2018.
- A formula for p-completion by way of the Segal conjecture, AMS sectional, Columbus, Spring 2018.
- The character of the total power operation, Midwest Topology Conference, Northwestern, Spring 2018.
- The character of the total power operation, Johns Hopkins Topology Seminar, Spring 2018.
- A whirlwind tour of chromatic homotopy theory, University of Kentucky topology seminar, Spring 2018.
- The character of the total power operation, Lloyd Roeling Topology Conference, UL Lafayette, Fall 2017.
- Power operations for field theories and elliptic cohomology, Workshop on field theories, Notre Dame, Fall 2017.
- The character of the total power operation, Electronic Computational Homotopy Theory Seminar, Spring 2017.
- The character of the total power operation, Notre Dame Topology Seminar, Fall 2016.
- Character theory for Fusion Systems, Hausdorff Institute for Mathematics, Fall 2016.
- An introduction to the stable motivic category, Regensburg, Fall 2016.
- Transchromatic character theory, Hausdorff Institute for Mathematics, Fall 2016.

- The Infinite Primes in Chromatic Homotopy Theory, University of Regensburg SFB seminar, Summer 2016.
- The Infinite Primes in Chromatic Homotopy Theory, MIT topology seminar, Spring 2016.
- The Character of the Total Power Operation, Northwestern topology seminar, Spring 2016.
- The Infinite Prime in Chromatic Homotopy Theory, UIUC topology seminar, Spring 2016.
- The Infinite Prime in Chromatic Homotopy Theory, Bonn topology working group, Spring 2016.
- Galois theory of the Drinfeld ring and Power Operations for Morava E-theory, Bochum Topology seminar, Spring 2016.
- Adams operations and Hopf invariant one, Hebrew University Kan Seminar, Fall 2015.
- The character of the total power operation, Hebrew University Kazhdan Seminar, Fall 2015.
- Hopkins-Kuhn-Ravenel character theory, Hebrew University Kazhdan Seminar, Fall 2015.
- Generic Phenomena in Chromatic Homotopy Theory, 24th NRW topology meeting, Fall 2015.
- Galois theory of the Drinfeld ring and Power Operations for Morava E-theory, Bonn topology working group, Fall 2015.
- From Morava's E-theories towards local Jacquet-Langlands, Workshop on Interactions between Arithmetic and Homotopy, Fall 2015.
- Étale Homotopy Theory, MPIM Seminar in pairs, Summer 2015.
- Height 1 vs Height 2, Chromatic homotopy theory working group, Summer 2015.
- The Character of the Total Power Operation, Strasbourg Topology Seminar, Spring 2015.
- The Character of the Total Power Operation, UIUC Topology Seminar, Spring 2015.
- The Character of the Total Power Operation, MIT Special Topology Seminar, Spring 2015.
- An Introduction to Morava E-theory, Muenster Leray Seminar, Fall 2014.
- Interactions between Morava E-theory, algebraic geometry, and representation theory, MPIM Topology Seminar, Fall 2014.
- An Introduction to Morava E-theory, MPIM Topology Seminar, Fall 2014.
- Character Theory and Strickland's Theorem, Ruhr-Universitat Bochum Topology Seminar, Fall 2014.
- A Transchromatic Proof of Strickland's Theorem, Oberwolfach Gong Show, Fall 2014.
- The E-theory of Symmetric Groups, MIT Topology Seminar, Spring 2014.
- The Morava E-theory of Symmetric Groups: character theory and Strickland's theorem, Harvard Thursday Seminar, Spring 2014.
- A New Proof of Strickland's Theorem, Johns Hopkins Topology Seminar, Fall 2013.
- The E-theory of Centralizers in Symmetric Groups, University of Minnesota Topology Seminar, Spring 2013.
- The E-theory of Centralizers in Symmetric Groups, Stanford University Topology Seminar, Spring 2013.

- An Introduction to HKR Character Theory, Talbot Seminar, Spring 2013.
- Power Operations and the Bousfield-Kuhn Functor, E-theory Seminar, Spring 2013.
- Height Amplification as an Adjunction, E-theory Seminar, Spring 2013.
- E-theory: future directions, E-theory Seminar, Spring 2013.
- The Cohomology of Centralizers in Symmetric Groups, Workshop on Equivariant, Chromatic, and Motivic Homotopy Theory, Northwestern University, Spring 2013.
- Subgroups of p-Divisible Groups and Morava E-theory, University of Kentucky Topology Seminar, Spring 2013.
- An Application of Transchromatic Generalized Character Theory, University of Virginia Topology Seminar, Fall 2012.
- An Application of Transchromatic Generalized Character Theory, MIT Topology Seminar, Fall 2012.
- Transchromatic Generalized Character Maps and More, Strings and Automorphic Forms in Algebraic Topology, RUB Bochum, Fall 2012.
- Transchromatic Twisted Character Maps, UIUC Topology Seminar, Spring 2012.
- Transchromatic Generalized Character Maps, Wayne State Topology Seminar, Spring 2012.
- Towards Transchromatic Twisted Character Maps, MIT Topology Seminar, Fall 2011.
- Transchromatic Generalized Character Maps, Northwestern Topology Seminar, Fall 2010.
- Transchromatic Generalized Character Maps, Johns Hopkins Topology Seminar, Fall 2010.
- Stacks and Descent, UIUC Graduate Student Geometry & Topology Seminar, Fall 2010.
- Transchromatic Generalized Character Maps, UIUC Topology Seminar, Spring 2010.
- Abstracting Monoids, UIUC Graduate Student Topology & Geometry Seminar, Fall 2009.
- HKR and Algebraic Geometry, UIUC Graduate Student Topology & Geometry Seminar, Spring 2009.
- The Derived Functors of Modular Forms and the Homotopy of TMF, UIUC Graduate Student Algebraic Geometry Seminar, Fall 2008.
- A Homotopy Theory for Stacks, UIUC Graduate Student Topology & Geometry Seminar, Spring 2008.
- An Introduction to Formal Group Laws, UIUC Graduate Student Topology & Geometry Seminar, Spring 2007.