# KYLE MICHAEL ORMSBY CURRICULUM VITAE

Department of Mathematics University of Washington Padelford Hall C–524 Seattle, WA 98195 (971) 276-3737 ormsbyk@uw.edu kyleormsby.github.io Pronouns: he or they

#### **Research Interests**

- Algebraic topology with an emphasis on motivic, equivariant, and combinatorial homotopy theory
- Geometric and topological data analysis applied to Alzheimer's disease and related dementia research

## Education

- Ph.D., Mathematics, University of Michigan Ann Arbor, 2010
- B.A., Mathematics, University of Chicago, 2006

#### Appointments

- Visiting Associate Professor, Department of Mathematics, University of Washington, 2022 present
- Co-Investigator, National Alzheimer's Coordinating Center, University of Washington, 2022 present
- Associate Professor, Department of Mathematics, Reed College, 2020 present
- Assistant Professor, Department of Mathematics, Reed College, 2014 2020
- Visiting Researcher, Mathematical Sciences Research Institute, 2014
- NSF Postdoctoral Fellow, Department of Mathematics, MIT, 2011 2014
- RTG Moore Instructor, Department of Mathematics, MIT, 2010 2011
- Visiting Researcher, Department of Mathematics, University of Oslo, August 2009

#### **Publications**

- 1. Computations in stable motivic homotopy theory, Ph.D. Thesis, University of Michigan, 2010, 1-84.
- 2. *Remarks on motivic homotopy theory over algebraically closed fields*, with Po Hu and Igor Kriz, J. K-Theory 7 (2011), no. 1, 55–89.
- 3. *Convergence of the motivic Adams spectral sequence*, with Po Hu and Igor Kriz, J. K-theory 7 (2011), no. 3, 573–596.
- 4. Motivic invariants of p-adic fields, J. K-theory 7 (2011), no. 3, 597-618.
- 5. The homotopy limit problem for Hermitian K-theory, equivariant motivic homotopy theory, and motivic Real cobordism, with Po Hu and Igor Kriz, Adv. Math. 228 (2011), no. 1, 434–480.
- 6. *Motivic Brown-Peterson invariants of the rationals*, with Paul Arne Østvær, Geom. Top. 17 (2013) 1671–1706.
- 7. Stable motivic  $\pi_1$  of low-dimensional fields, with Paul Arne Østvær, Adv. Math. 265 (2014), 97–131.
- 8. On the homotopy of Q(3) and Q(5) at the prime 2, with Mark Behrens, Algebr. Geom. Topol. 16 (2016), no. 5, 2459–2534.
- 9. *Galois equivariance and stable motivic homotopy theory*, with Jeremiah Heller, Trans. Amer. Math. Soc. 368 (2016), no. 11, 8047–8077.
- 10. The stable Galois correspondence for real closed fields, with Jeremiah Heller, New directions in homotopy theory, Cont. Math. 707 (2018), 1–9.
- 11. *Primes and fields in stable motivic homotopy theory*, with Jeremiah Heller, Geom. Topol. 22 (2018), no. 4, 2187–2218.
- 12. *Vanishing in stable motivic homotopy sheaves*, with Paul Arne Østvær and Oliver Röndigs, Forum Math. Sigma 6 (2018), e3, 20pp.
- 13. On the ring of cooperations for 2-primary connective topological modular forms, with Mark Behrens, Nathaniel Stapleton, and Vesna Stojanoska, J. Topol. 12 (2019), no. 2, 577–657.

- 14. The homotopy groups of the  $\eta$ -periodic motivic sphere spectrum, with Oliver Röndigs, Pacific J. Math. 306 (2020), no. 2, 679–697.
- 15. *Biased permutative equivariant categories*, with Kayleigh Bangs, Skye Binegar, Young Kim, Angélica Osorno, David Tamas-Parris, and Livia Xu, Homology Homotopy Appl. 23 (2021), no. 1, 77–100.
- 16. Self-duality of the lattice of transfer systems via weak factorization systems, with Evan Franchere, Angélica Osorno, Weihang Qin, and Riley Waugh, Homology Homotopy Appl. 24 (2022) no. 2, 115–134.
- 17. Saturated and linear isometric transfer systems for cyclic groups of order  $p^mq^n$ , with Usman Hafeez, Peter Marcus, and Angélica Osorno, Topology Appl. 317 (2022), Paper No. 108162, 20pp.
- 18. *Model structures on finite total orders*, with Scott Balchin, Angélica Osorno, and Constanze Roitzheim, Math. Z. 304 (2023), no. 3, Paper No. 40, 35pp.
- 19. Lifting  $N_{\infty}$  operads from conjugacy data, with Scott Balchin and Ethan MacBrough, Tunisian J. Math. 5 (2023), no. 3, 479–504.
- 20. Composition closed premodel structures and the Kreweras lattice, with Scott Balchin and Ethan MacBrough, Euro. J. Combinatorics 116 (2023), 103879 (22pp).
- 21. A motivic analogue of the K(1)-local sphere spectrum, with William Balderrama and J.D. Quigley, accepted in J. Euro. Math. Soc., arXiv:2307.13512, 9pp.

### Preprints

- 22. *Hochschild homology of mod-p motivic cohomology over algebraically closed fields*, with Bjørn Dundas, Mike Hill, and Paul Arne Østvær, submitted, arXiv:2204.00441, 27pp.
- 23. The combinatorics of  $N_{\infty}$  operads for  $C_{qp^n}$  and  $D_{p^n}$ , with Scott Balchin and Ethan MacBrough, submitted, arXiv:2209.06992, 20pp.
- 24. *Transfer systems for rank two elementary Abelian groups: characteristic functions and matchstick games*, with Linus Bao, Christy Hazel, Tia Karkos, Alice Kessler, Austin Nicolas, Jeremie Park, Cait Schleff, and Scotty Tilton, submitted, arXiv:2310.13835, 25pp.

## In preparation

- 25. Discrete structures, textbook with David Perkinson, draft at https://kyleormsby.github.io/ files/113full\_text.pdf, 193pp.
- 26. Topological network analysis of beta-amyloid and tau in Alzheimer's disease using PET imaging data, with Yuexuan Wu, Dean Shibata, Yen-Chi Chen, Sarah Biber, Walter A. Kukull, and Kwun Chuen Gary Chan.
- 27. Persistent symmetry: a homological approach to symmetry detection in images, with Shanna Goldman, Olivia McGough, Angélica Osorno, and Dale Schandelmeier-Lynch.

#### Abstracts

1. Topological network analysis of beta-amyloid and tau in Alzheimer's disease using PET imaging data, with Yuexuan Wu, Dean Shibata, Yen-Chi Chen, Sarah Biber, Walter A. Kukull, and Kwun Chuen Gary Chan, Alzheimer's Association International Conference (2023).

#### Student papers supervised

- 1. Riley Thornton, *The homogeneous spectrum of Milnor-Witt K-theory*, J. Algebra 459 (2016), 376–388.
- Ricardo Rojas-Echenique, *Injectivity and surjectivity of the Dress map*, J. Pure Appl. Algebra 220 (2016), no. 12, 3816–3820
- 3. Maxine Calle and Sam Ginnett with an appendix by Harry Chen and Xinling Chen, *The Tambara structure of the trace ideal for cyclic extensions*, J. Algebra 560 (2020), 114–143.
- 4. Maxine Calle and Sam Ginnett, *The spectrum of the Burnside Tambara functor of a cyclic group*, J. Pure Appl. Algebra 227 (2023), no. 8, Paper No. 107344, 23pp.

5. Ethan MacBrough, *Equivariant linear isometries operads over Abelian groups*, submitted, arXiv: 2311.08797, 36pp.

# Undergraduate theses advised

- 1. Andrew Erlanger, *Dehn surgery* (2015)
- 2. Riley Thornton, Some problems are hard : Borel complexity and  $C^*$ -algebras (2016)
- 3. Joseph Joe (Mathematics/Physics, co-adviser Daniel Borrero), 256 shades of grey: topological analysis of the Gray-Scott model using persistence landscapes (2016)
- 4. Chris Henn, The modular flow in three homeomorphic spaces (2018)
- 5. Alex Lloyd-Damnjanovic, Kronecker sequences and persistent homology (2019)
- 6. Torin Woods-Eliot, The type A cluster algebra and Catalan combinatorics (2019)
- 7. Caroline Yearwood, The dual Steenrod algebra and graph theory (2019)
- Jialun Zhao (Mathematics/Physics, co-adviser Andrew Larkoski), *The AdS*<sub>3</sub>/*CFT*<sub>2</sub> correspondence (2019)
- 9. Rowen Bangs (Mathematics/Philosophy, co-adviser Paul Hovda), *This thesis is indeducible: Approaches for justifying the consistency of Peano arithmetic after Gödel* (2020)
- 10. Maxine Calle, Morse theory and flow categories (2020)
- 11. Anton Zavorotny, Vassiliev knot invariants and the graph bialgebra of Lando (2020)
- 12. Francis Baer, Adams spectral sequence computations of  $BP\langle 1 \rangle_* BP\langle 1 \rangle$  (2021)
- 13. Usman Hafeez,  $\mathbb{A}^1$ -Milnor numbers (2021)
- 14. Albert Ji (Mathematics/Computer Science, co-adviser Mark Hopkins), Universal Approximation and Interpolation in Neural Networks (2021)
- 15. Weihang Qin (Mathematics/Computer Science, co-adviser Jim Fix), *Raymarching hyperbolic geometry* (2021)

# **Honors and Grants**

- Co-Investigator on National Institute of Aging award U01 AG082350, *CLarity in ADRD Research Through Imaging (CLARiTI)*, \$149M, 2023–2028. (Contributed to grant writing, methods team member, 0.15FTE support.)
- Senior personnel on NSF award DMS-2135884, *RTG: Electronic Computational Homotopy Theory* (*eCHT*) *Research Community*, \$1.2M, 2022–2025. (Contributed to grant writing, served as Director for inaugural eCHT REU in 2023, PI of Reed College subaward.)
- NSF award DMS-2204365, *Motivic, operadic, and combinatorial homotopy theory* (joint with Angélica Osorno), \$345,010, 2022–2025.
- NSF award DMS-1709302, *Higher structures in stable, equivariant, and motivic homotopy theory* (joint with Angélica Osorno), \$368,000, 2017–2021.
- NSF conference grant DMS-1722545, *Homotopy theory in the ecliptic: chromatic, equivariant, and motivic mathematics* (joint with Angélica Osorno, Michael Hill, Agnès Beaudry, and John Lind), \$30,000, 2017.
- NSF conference grant DMS-1462793, *Equivariant and motivic homotopy theory* (joint with Angélica Osorno), \$28,000, 2015.
- NSF award DMS-1406327, *Structure and computations in motivic and chromatic homotopy*, \$172,146, 2014–2017.
- NSF Mathematical Sciences Postdoctoral Research Fellowship, \$135,000, 2011–2014
- Rackham One-Term Dissertation Fellowship, Winter 2010
- Honorable Mention, NSF Graduate Research Fellowship, 2006
- University of Chicago Phi Beta Kappa, 2005

## **Refereeing and Grant Review**

• Annals of Mathematics, Documenta Mathematica, Journal of Homotopy and Related Structures, Journal of Topology, Mathematische Zeitschrift, National Science Foundation, New York Journal of Mathematics, Proceedings of the AMS

### **Academic and Professional Activities**

- Co-organizer of an AMS Mathematics Research Community on homotopical combinatorics, Beaver Hollow, 2024
- Director for the Electronic Computational Homotopy Theory (eCHT) Research Experience for Undergraduates, virtual, 2023
- Co-organizer of the *Collaborative Mathematics Research Group*, a summer research program for Reed College undergraduates, 2023, 2020, 2019, & 2018
- Co-organizer of the University of Washington Topology Seminar, 2022 present
- Project mentor for the Washington Experimental Mathematics Laboratory (WXML), 2022
- Lecturer for the Undergraduate Faculty Program, PCMI (virtual), 2021
- Founder and faculty liaison for the SL(m) (Social/Liaison Mathematics Group) at Reed College, 2019 2022
- Co-organizer of the Mathematics Teacher-Scholar Symposium (MaTSS), a two-day virtual conference encouraging emerging researchers committed to inclusive curricular and pedagogical practices to consider careers as teacher-scholars in a liberal arts setting, 2021
- Chair of the Reed College Department of Mathematics, 2020 2021
- Chair of the Academic Success Committee, 2020 2021
- Member of the Reed College Academic Planning Working Group (COVID response), summer 2020
- Organizer of the Reed College Mathematics Colloquium, 2014 2019 (joint with Jamie Pommersheim in 2014–15)
- Co-organizer of Cascade Topology Seminar, Portland State University, 2019
- Co-organizer of the special session *Homotopy Theory* at the AMS Spring Western/Central Sectional Meeting, University of Hawai'i at Mānoa, 2019
- Invited participant, *Homotopy Harnessing Higher Structures* program at the Isaac Newton Institute of Mathematical Sciences, 2018
- Co-organizer of special session *Motivic Homotopy Theory* at the AMS Spring Western Sectional Meeting, Portland State University, 2018
- Co-organizer of Underrepresented Students in Topology and Algebra Research Symposium (USTARS), Reed College, 2018
- Co-organizer of *Homotopy Theory in the Ecliptic: Chromatic, Equivariant, and Motivic Mathematics,* Reed College, 2017
- Organizer of *Project Project*, a summer research program for five Reed undergraduate students focused on mathematics visualization, 2017
- Invited participant, *Homotopical Methods in Algebraic Geometry*, Institut Mittag-Leffler, Sweden, 2017
- Invited participant, *Topology* workshop at the Mathematisches Forschungsinstitut Oberwolfach, Germany, 2016
- Co-organizer of West Coast Algebraic Topology Summer School, University of Oregon, 2016
- Co-organizer of Equivariant Derived Algebraic Geometry workshop at AIM, 2016.
- Co-organizer of Cascade Topology Seminar, Portland State University, 2015
- Organizer of the K-group, a summer research program for three Reed undergraduate students, 2015
- Co-organizer of Equivariant and Motivic Homotopy Theory conference, Reed College, 2015
- Invited participant, *Homotopy Theory* workshop at the Mathematisches Forschungsinstitut Oberwolfach, Germany, 2015

- Organizer of Motivic Homotopy Seminar, MSRI, 2014
- Invited participant, Algebraic Topology semester, MSRI, 2014
- Freshman academic advisor, MIT, 2012 2013
- Undergraduate research mentor for Peter Wear (Summer 2012), XiaoLin Shi (Spring 2012), and Taylor Han (Spring 2013)
- AMS Math Reviews contributor, 2012 present
- MIT Mathematics CI Space contributor, Fall 2011, Spring 2011
- Summer Seminar on QFT organizer, Summer 2011
- Undergraduate Reading Seminar organizer, Univ. of Michigan, 2007 2009
- Michigan Math and Science Scholars teaching assistant, Summer 2009
- Undergraduate Math Club speaker, Univ. of Michigan, Winter 2009
- Young Scholars Program counselor, Univ. of Chicago, Summer 2005, Summer 2004

#### **Teaching Experience**

- Math 544–546, Topology & geometry of manifolds (UW), 2022-23
- Math 342, Topology (Reed), Spring 2021, Spring 2016
- Math 201, Linear Algebra (Reed), Spring 2021, Fall 2018
- Math 341, Topics in Geometry (Reed), Spring 2020
- Math 311, Complex Analysis (Reed), Spring 2019
- Math 113, Discrete Structures (Reed), Fall 2020, Spring 2020, Fall 2019, Spring 2019, Spring 2018, and Fall 2017
- Math 412, Topics in Algebra [Galois Theory] (Reed), Fall 2018
- Math 481, Independent study [of equivariant operads] (Reed), Fall 2018
- Math 202, Vector Calculus (Reed), Spring 2018
- Math 212, Multivariable calculus II (Reed), Spring 2016
- Math 138, Knot theory, knot practice (Reed), Fall 2015
- Math 211, Multivariable calculus I (Reed), Fall 2015
- Math 332, Abstract algebra (Reed), Spring 2015
- Math 112, Introduction to analysis (Reed), Spring 2015
- Math 481, Independent study [of 2-variable modular forms] (Reed), Spring 2015
- Math 481, Independent study [of Morse theory] (Reed), Spring 2015
- Math 111, Calculus (Reed), Fall 2014
- 18.A39, Knot theory seminar instructor (MIT), Fall 2012
- 18.02, Multivariable calculus recitation leader (MIT), Fall 2012, Fall 2010
- 18.100C, Analysis recitation leader with emphasis on communication (MIT), Fall 2011, Spring 2011
- Math 215, Multivariable calculus teaching assistant (Univ. of Michigan), Winter 2009
- Math 116, Integral calculus co-coordinator (Univ. of Michigan), Winter 2008
- Math 116, Integral calculus instructor (Univ. of Michigan), Fall 2007, Winter 2007
- Math 115, Differential calculus instructor (Univ. of Michigan), Fall 2006

#### **Invited Presentations**

- $N_{\infty}$  operads and the combinatorics of model structures, Homotopy Theory Meeting, Oberwolfach Research Institute for Mathematics, 2023.
- Counting in Catalan: handshakes, trees, & paths, Math Hour, University of Washington, 2023.
- Homotopical combinatorics, Cascade Topology Seminar, University of British Columbia, 2023.
- Some homotopy groups of  $S^0$ , Electronic Computational Homotopy Theory Seminar, 2023.
- *Transfer systems and model structures for combinatorialists*, Combinatorics and Geometry Seminar, University of Washington, 2023.
- Homotopical combinatorics, Topology Seminar, University of Washington, 2022.

- *Homotopical combinatorics*, Special Session on Equivariant and Motivic Homotopy Theory at the AMS Western Sectional Meeting, virtual, 2021.
- *Weak factorization and transfer systems*, Algebraic topology seminar, University of Michigan Ann Arbor (virtual), 2020.
- Weak factorization and transfer systems, Cascade Topology Seminar, University of British Columbia (virtual), 2020.
- Tambara generators for the trace ideal, Algebraic topology seminar, UCLA, 2020.
- Schröder numbers, separable permutations, and the C<sub>2</sub>-equivariant categorical Barratt-Eccles operad, Topology seminar, University of Puget Sound, 2019.
- *The structure of the homotopy groups of the motivic sphere spectrum*, Topology seminar, University of Washington, 2019.
- *The structure of the homotopy groups of the motivic sphere spectrum*, Topology seminar, University of Oregon, 2019.
- *The*  $\eta$ *-periodic motivic sphere*, Homotopy Theory Summer Berlin (Motivic Homotopy Groups of Spheres: III), Berlin, Germany, 2018.
- *Towards the*  $\eta$ *-periodic motivic sphere*, Special Session on Structured Homotopy Theory at the AMS Central Sectional Meeting, Ann Arbor, Michigan, 2018.
- Vanishing in motivic stable stems, Mathematical Congress of the Americas, Montréal, Canada, 2017.
- Vanishing in motivic stable stems, Institut Mittag-Leffler, 2017.
- Vanishing in motivic stable stems, Topology seminar, MIT, 2016.
- *Primes and fields in stable motivic homotopy theory*, Motivic homotopy groups of spheres: II, Essen, Germany, 2016.
- *Level structures and cooperations in* TMF, Equivariant derived algebraic geometry, Banff International Research Station, 2016.
- Regular polytopes in three and more dimensions, F.L. Griffin MathFest, Reed College, 2016.
- *Galois equivariance and stable motivic homotopy theory*, Topology seminar, University of British Columbia, 2015.
- *Motivic homotopy groups over low-dimensional fields*, West Coast Algebraic Topology Summer School, University of Oregon, 2015.
- *Homotopy theoretic perspectives on groups and varieties*, Oregon State University Mathematics Colloquium, Salem, Oregon, 2015.
- *Cooperations in K-theory and topological modular forms*, University of Oregon Topology Seminar, Eugene, Oregon, 2015.
- *Connective, effective, and essential Hermitian K-theory*, Special Session on Homotopy Theory at the AMS Western Sectional Meeting, San Francisco, California, 2014.
- Galois equivariance and motivic homotopy, Geometry Topology seminar, Georgia Institute of Technology, 2013.
- Galois equivariance and motivic homotopy, Topology seminar, MIT, 2013.
- Motivic stable stems, Topology seminar, Stanford University, 2013.
- Quaternions and Dirac's belt trick, Reed College mathematics colloquium, 2013.
- *Towards the first motivic stable stem*, Workshop on Equivariant, Chromatic, and Motivic Homotopy Theory, Northwestern University, 2013.
- Algebraic deformations of rational functions, Reed College mathematics colloquium, 2013.
- Motivic Brown-Peterson invariants of the rationals, Topology seminar, MIT, 2012.
- *Chromatic red shift*, West Coast Algebraic Topology Summer School: Advances in *K*-theory, Stanford University, 2012.
- TMF cooperations, Virginia Conference on Algebraic Topology, University of Viginia, 2012.
- Tate normal form in level resolutions of the K(2)-local sphere, Topology seminar, University of Minnesota, 2012.

- Tate normal form in level resolutions of the K(2)-local sphere, Topology seminar, University of Virginia, 2011.
- *Tate normal form in level resolutions of the* K(2)*-local sphere*, Topology seminar, Johns Hopkins University, 2011.
- New advances in topological modular forms, Topology seminar, University of Michigan, 2011.
- Tate normal form in level resolutions of the K(2)-local sphere, Topology seminar, MIT, 2011.
- *Equivariant motivic homotopy and the completion problem for Hermitian K-theory*, Algebra seminar, University of Southern California, 2011.
- *Equivariant motivic homotopy and the completion problem for Hermitian K-theory*, Toplogy seminar, MIT, 2010.
- Equivariant motivic homotopy and the completion problem for Hermitian K-theory, Geometric aspects of motivic homotopy theory, Bonn, Germany, 2010.
- *The motivic alpha family over p-adic fields*, Geometry/topology seminar, University of Western Ontario, 2010.
- The motivic alpha family over p-adic fields, Topology seminar, University of Notre Dame, 2009.
- *The motivic alpha family over p-adic fields*, Topology seminar, University of Illinois Urbana-Champaign, 2009.
- Computations in stable motivic homotopy theory, Topology seminar, University of Oslo, 2009.
- *Computations in stable motivic homotopy theory*, Graduate Student Topology & Geometry Conference, University of Wisconsin Madison, 2009.
- Some remarks on 2-completed motivic homotopy theory and the motivic J-homomorphism, Topology seminar, University of Chicago, 2009.
- Some remarks on 2-completed motivic homotopy theory and the motivic J-homomorphism, AMS Special Session on Homotopy Theory and Higher Categories, Joint Mathematics Meeting, Washington, D.C., 2009.