

Akhil Mathew

Contact Information

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Employment

Clay Research Fellow, Clay Mathematics Institute (2017–2022).

Visiting Assistant Professor, University of Chicago (fall 2018 quarter).

Education

Harvard University, Cambridge, MA.

PhD in mathematics, 2017.

Thesis: *Nilpotence and descent in stable homotopy theory*.

Thesis advisor: Jacob Lurie.

University of California at Berkeley, Berkeley, CA.

PhD student in mathematics, 2014–2015.

Harvard University, Cambridge, MA.

A.B., *summa cum laude* in Mathematics, 2014.

Visiting positions

Mathematical Sciences Research Institute, Berkeley, California.

Research member, Jan.–May 2019.

Program on *Derived algebraic geometry*.

Hausdorff Institute of Mathematics, Bonn, Germany.

Program participant for October and November 2016.

Junior trimester program on *Topology*.

Hausdorff Institute of Mathematics, Bonn, Germany.

Program participant from May–August 2015.

Trimester program on *Homotopy theory, manifolds, and field theories*.

Awards

Clay Research Fellowship, 2017

Honorable Mention for Frank and Bennie Morgan Prize for undergraduate research, 2015

NSF Graduate Research Fellowship, 2014

David Mumford Prize at Harvard University, 2014
Thomas T. Hoopes Prize at Harvard University, 2014
Phi Beta Kappa, 2013
3rd place in Intel Science Talent Search, 2010

Papers

- Derived induction and restriction theory, with N. Naumann and J. Noel. 2015. To appear in *Geom. Topol.* Preprint available at arXiv:1507.06867.
- Monadicly of the Bousfield-Kuhn functor, with R. Eldred, G. Heuts, and L. Meier. To appear in *Proc. Amer. Math. Soc.* Preprint available at arXiv:1707.05986.
- On the Blumberg-Mandell Künneth theorem for TP, with B. Antieau and T. Nikolaus. To appear in *Selecta Mathematica.* Preprint available at arXiv:1710.05658.
- Descent in algebraic K -theory and a conjecture of Ausoni-Rognes, with D. Clausen, N. Naumann, and J. Noel. To appear in *JEMS.* Preprint available at arXiv:1606.03328.
- Examples of descent up to nilpotence. To appear in the Proceedings of the PIMS Workshop on Geometric and Topological Aspects of the Representation Theory of Finite Groups. Preprint available at arXiv:1701.01528.
- A short proof of telescopic Tate vanishing, with D. Clausen. *Proc. Amer. Math. Soc.* **145** (2017), no. 12, 5413–5417.
- Picard groups of higher real K -theory spectra at height $p - 1$, with D. Heard and V. Stojanoska. *Compos. Math.* **153** (2017), 1820–1854.
- Residue fields for a class of rational E_∞ -rings and applications. *J. Pure Appl. Algebra* **221** (2017), no. 3, 707–748.
- Nilpotence and descent in equivariant stable homotopy theory, with N. Naumann and J. Noel. *Adv. Math.* **305** (2017), 994–1084.
- THH and base-change for Galois extensions of ring spectra. *Algebr. Geom. Topol.* **16** (2016), 1025–1041.
- The Picard group of topological modular forms via descent theory, with V. Stojanoska. *Geom. Topol.* **20** (2016), no. 6, 3133–3217.
- The homology of tmf . *Homology Homotopy Appl.* **18** (2016), no. 18, 1–29.
- Torsion exponents in stable homotopy and the Hurewicz homomorphism. *Algebr. Geom. Topol.* **16** (2016), no. 2, 1025–1041.
- The Galois group of a stable homotopy theory. *Adv. Math.* **291** (2016), 403–541.
- Fibers of partial totalizations of a pointed cosimplicial space, with V. Stojanoska. *Proc. Amer. Math. Soc.* **144** (2016), no. 1, 445–458.
- On a nilpotence conjecture of J.P. May, with N. Naumann and J. Noel. *J. Topol.* **8** (2015), no. 4, 917–932.

A thick subcategory theorem for modules over certain ring spectra. *Geom. Topol.* **19** (2015), no. 4, 2359–2392.

Affineness and chromatic homotopy theory, with L. Meier. *J. Topol.* **8** (2015), no. 2, 476–528.

Categories parametrized by schemes and representation theory in complex rank. *J. Algebra* **381** (2013), 140–163.

Preprints

The arc-topology, with B. Bhatt. 2018. arXiv:1807.04725.

Revisiting the de Rham-Witt complex, with B. Bhatt and J. Lurie. 2018. arXiv:1805.05501.

K -theory and topological cyclic homology of henselian pairs, with D. Clausen and M. Morrow. 2018. arXiv:1803.10897.

Kaledin’s degeneration theorem and topological Hochschild homology. 2017. arXiv:1710.09045.

Torus actions on stable module categories, Picard groups, and localizing subcategories. 2015. arXiv:1512.01716.

Appendix to “Representations of finite groups on modules over K -theory,” by David Treumann. 2015. arxiv:1503.02477.

Conference/workshop talks

Derived Algebraic Geometry and its Applications, Mathematical Sciences Research Institute, Berkeley (March 2019).

CATS5, Categories and stacks in algebraic geometry, Lisbon (Oct. 2018).

Witt Vectors, Deformations, and Absolute Geometry, University of Vermont (July 2018).
A gentle approach to the de Rham-Witt complex.

Mathematisches Forschungsinstitut Oberwolfach Workshop on Topologie (July 2018).
 p -adic K -theory and topological cyclic homology.

Berlin Mathematics School, Homotopy Theory Summer (June 2018).
Applications of topological cyclic homology and cyclotomic spectra (Three lectures).

Midwest Topology Seminar, Northwestern University (March 2018).
Rigidity in algebraic K -theory and topological cyclic homology.

Workshop on THH , Nagano Prefecture (Sep. 2017).
Two lectures on THH and crystalline cohomology.

SUNY Buffalo Topology day (Sep. 2017).
Algebraic K -theory, polynomial functors, and λ -rings.

Stacks Project Workshop, University of Michigan at Ann Arbor (July 2017).
Nonconnective simplicial commutative rings.

Triangulated Categories and Geometry – a conference in honor of Amnon Neeman’s 60th birthday, University of Bielefeld (May 2017).
Polynomial functors and algebraic K -theory.

Cascade Topology Seminar, University of British Columbia (May 2017).

Polynomial functors and algebraic K-theory.

NRW Topology Meeting, University of Wuppertal (April 2017).

Polynomial functors and algebraic K-theory.

Subfactors, Higher Geometry, Higher Twists and Almost Calabi-Yau Algebras, Isaac Newton Institute, Cambridge, U.K. (March 2017).

Polynomial functors and algebraic K-theory.

Workshop on Geometric and Topological Aspects of the Representation Theory of Finite Groups, Pacific Institute for the Mathematical Sciences, University of British Columbia (Aug. 2016).

Torus actions on stable module categories and applications.

Mathematisches Forschungsinstitut Oberwolfach Workshop on Topologie (July 2016).

Derived induction and restriction theory. (30 minute talk).

Young Topologists Meeting at University of Copenhagen, mini-course (July 2016).

Nilpotence, descent, and algebraic K-theory. (Four lectures).

Workshop on Group Actions – Classical and Derived at Fields Institute for Research in Mathematical Sciences (June 2016).

Galois extensions and Picard groups of ring spectra.

Operations in Highly Structured Homology Theories, Banff International Research Station (May 2016).

On a nilpotence conjecture of J.P. May.

Equivariant Derived Algebraic Geometry, Banff International Research Station (February 2016).

Descent in algebraic K-theory.

Workshop on Homotopy Theory, Manifolds, and Field Theories, at Max Planck Institute for Mathematics (June 2015).

Descent in algebraic K-theory via May's nilpotence conjecture.

Mathematisches Forschungsinstitut Oberwolfach workshop on Homotopy Theory (March 2015).

Descent and nilpotence in stable homotopy theory.

Modular Invariants in Topology and Analysis conference at University of Regensburg (Sep. 2014).

Descent for structured ring spectra and applications.

Seminar talks

Ohio State University, K -theory seminar (November 2018).

Columbia University, Algebraic Geometry seminar (September 2018).

The arc-topology.

University of Wisconsin, Algebra and Algebraic Geometry Seminar (September 2018).

Kaledin's noncommutative degeneration theorem and topological Hochschild homology.

MIT, Topology seminar (September 2018).

p -adic K -theory and topological cyclic homology.

University of Oregon, Topology seminar (May 2018).

p-adic K-theory and topological cyclic homology.
University of Oregon, colloquium (May 2018).
Integral p-adic Hodge theory (after Bhatt, Morrow, and Scholze).

University of Maryland, College Park, Algebra/Number Theory seminar (April 2018).
A gentle approach to the de Rham-Witt complex.

University of Michigan, Algebraic Geometry seminar (April 2018).
Kaledin's noncommutative degeneration theorem and topological Hochschild homology.

UIUC Algebraic Geometry seminar (March 2018).
A gentle approach to the de Rham-Witt complex.

Stanford University, Topology seminar (March 2018).
p-adic K-theory and topological cyclic homology.

Notre Dame, Topology seminar (Feb. 2018).
p-adic K-theory and topological cyclic homology.

University of California at Berkeley, colloquium (Feb. 2018).
p-adic K-theory and topological cyclic homology.

University of Utah, Commutative Algebra seminar (Feb. 2018).
Rigidity in algebraic K-theory and topological cyclic homology.

Cornell University, Oliver Club (department colloquium) (Feb. 2018).
p-adic K-theory and topological cyclic homology.

Cornell University, Topology seminar (Feb. 2018).
Kaledin's noncommutative degeneration theorem and topological Hochschild homology.

University of Copenhagen, Topology seminar (Jan. 2018).
Rigidity in algebraic K-theory and topological cyclic homology.

UIUC Topology seminar (Dec. 2017).
Algebraic K-theory, polynomial functors, and lambda-rings.

Purdue University Topology seminar (Nov. 2017).
Kaledin's noncommutative degeneration theorem and topological Hochschild homology.

Columbia University, Algebraic Geometry seminar (Oct. 2017).
Kaledin's noncommutative degeneration theorem and topological Hochschild homology.

University of Bonn, Topology seminar (Oct. 2017).
A gentle approach to the de Rham-Witt complex.

Université Paris 13 (Oct. 2017).
Algebraic K-theory, polynomial functors, and lambda-rings.

Institute de Mathématiques de Jussieu (Oct. 2017).
A gentle approach to the de Rham-Witt complex.

Nagoya University (Sep. 2017).
Polynomial functors and algebraic K-theory.

Morningside Center, Chinese Academy of Sciences (August 2017).

Derived induction and restriction theory.
University of Bonn, Topology seminar (May 2017).
Nonconnective simplicial commutative rings.

University of British Columbia, Topology seminar (May 2017).
Nonconnective simplicial commutative rings.

University of Illinois at Chicago Algebraic K -theory seminar (Jan. 2017).
Polynomial functors and algebraic K -theory.

University of Chicago Algebraic Topology seminar (Jan. 2017).
Polynomial functors and algebraic K -theory.

University of Michigan Algebraic Geometry seminar (Jan. 2017).
Polynomial functors and algebraic K -theory.

Georgia Institute of Technology Geometry and Topology seminar (Dec. 2016).
Polynomial functors and algebraic K -theory.

University of Hamburg, Kolloquium über Reine Mathematik (Nov. 2016).
The descent problem in algebraic K -theory.

University of Strasbourg, Algebra/Topology seminar (Nov. 2016).
Artin induction and algebraic K -theory.

Max Planck Institute for Mathematics, Topology seminar (Nov. 2016).
Artin induction and algebraic K -theory.

University of Oslo, Topology seminar (Oct. 2016).
Descent in algebraic K -theory.

University of Minnesota, Topology seminar (Sep. 2016).
Artin induction and algebraic K -theory.

University of Regensburg, Kepler-Kolloquium (July 2016).
Descent in the algebraic K -theory of ring spectra and a conjecture of Ausoni-Rognes.

University of Münster Oberseminar Topologie (July 2016).
Galois descent in algebraic K -theory via derived Dress induction.

UCLA Algebraic Topology seminar (April 2016).
Picard groups of structured ring spectra and stable module categories.

Johns Hopkins University Topology seminar (March 2016).
Galois descent in algebraic K -theory.

University of Illinois at Urbana-Champaign Topology seminar (March 2016).
Picard groups of structured ring spectra and stable module categories.

University of Michigan Algebraic Geometry seminar (Oct. 2015).
Descent theorems in algebraic K -theory.

University of Illinois at Chicago Algebraic Topology seminar (April 2015).
Descent and nilpotence in equivariant stable homotopy theory.

UC Riverside Topology Seminar (April 2015).

The Galois group in stable homotopy theory.

University of Copenhagen Algebra/Topology seminar (March 2015).

Derived induction and restriction theory.

Oberseminar at Max Planck Institute for Mathematics (March 2015).

The Galois group in stable homotopy theory.

UC Berkeley Topology seminar (Feb. 2015).

Derived induction and restriction theory.

Joint Mathematics Meetings in San Antonio, TX, in special session for research by undergraduates (Jan. 2015).

Descent for structured ring spectra and applications.

University of Chicago Algebraic Topology seminar (Feb. 2014).

The Galois group of a stable homotopy theory.

Stanford University joint Topology/Algebraic Geometry seminar (Feb. 2014).

The Galois group of a stable homotopy theory.

University of Regensburg Global Analysis seminar (Jan. 2014).

Affineness and chromatic homotopy theory.

University of Regensburg graduate seminar (Jan. 2014).

The Galois group of a stable homotopy theory.

Teaching

Course at University of Chicago

Perfectoid Spaces (topics course) in fall 2018.

Teaching fellow at Harvard University

Math 21b, Linear algebra and differential equations in spring 2017.

Course assistant (led sections and graded problem sets) at Harvard University (2011-2014):

Math 129 (number fields) in spring 2014.

Math 144 (model theory) in fall 2013.

Math 231b (advanced algebraic topology) in spring 2013.

Math 155 (combinatorics) in fall 2012.

Math 112 (introductory real analysis) in spring 2012.

Math 114 (measure theory and functional analysis) in fall 2011.

PROMYS counselor, Boston, MA (summer 2014)

Graded problem sets and individually worked with four high school students in an intensive summer camp focusing on elementary number theory.

MIT-PRIMES mentor, Cambridge, MA (2013-2014, 2016)

Mentored a high school student working on a project on Galois invariants of Belyi functions over 2013.

Reading course for two students on higher categories in spring 2014.

Reading course for two students on permutation groups in spring 2016.

Service

Referee work.

Reviewer for Zentralblatt.

Co-organizer, Algebraic Topology seminar at University of Chicago (2017-2018).

Co-organizer for conference “Invertible objects and duality in derived algebraic geometry” at University of Regensburg, April 2017.