

# Jonathan S. Beardsley

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## Research Summary

I use homotopy theory and category theory to study study objects from topology, geometry, mathematical physics and algebra. I have ongoing projects in the areas of derived noncommutative geometry, Galois and descent theory of structured ring spectra, chromatic homotopy theory, operadic descriptions of generalized knots and braids, and Koszul duality. I am especially interested in using homotopical methods to understand structures in classical algebra, topology, and geometry.

## Education

- Ph.D. in Mathematics, Johns Hopkins University, 2016  
Thesis Advisor: Jack Morava  
Thesis Title: “Coalgebraic Structure and Intermediate Hopf-Galois Extensions of Thom Spectra in Quasicategories”
- B.S. in Mathematics, University of Central Florida, 2010  
Thesis Advisor: Piotr Mikusiński  
Thesis Title: “A Sheaf of Boehmians”

## Employment

- University of Washington, Acting Assistant Professor, 2016 – present
- University of Melbourne, Visiting Appointment (ten days), 2017
- Johns Hopkins University, Graduate Teaching Assistant, 2010-2016

## Published or Submitted Papers

1. “The Operadic Nerve, Relative Nerve, and the Grothendieck Construction,” with L.Z. Wong, (Submitted, [arXiv:1808.08020](https://arxiv.org/abs/1808.08020))
2. “A Grothendieck Construction for Enriched Categories,” with L.Z. Wong, (Accepted for publication in *Advances in Mathematics*, [arXiv:1804.03829](https://arxiv.org/abs/1804.03829).)
3. “Toward a Galois Theory of the Integers Over the Sphere Spectrum,” with J. Morava, *Journal of Geometry and Physics* 131 (2018), 41–51.
4. “A Theorem on Multiplicative Cell Attachments with an Application to Ravenel’s  $X(n)$  Spectra,” (Forthcoming in *Journal of Homotopy and Related Structures*, [arXiv:1708.03042](https://arxiv.org/abs/1708.03042))
5. “A User’s Guide: Relative Thom Spectra via Operadic Kan Extensions,” *Enchiridion: Mathematical User’s Guides Vol. 3* (2017), 1–15.

6. "Relative Thom Spectra via Operadic Kan Extensions,"  
Algebraic & Geometric Topology 17-2 (2017), 1151–1162.
7. "A Sheaf of Boehmians," with P. Mikusiński  
Ann. Pol. Math. 107 (2013), 293–307.

### Preprints and Other Writing

1. "Thom Objects are Cotorsors"  
(arXiv:1810.00734)
2. "Topological Hochschild Homology of  $X(n)$ ,"  
(arXiv:1708.09486)
3. "Lubin Tate Cohomology and Deformations of  $n$ -buds,"  
(available on website)
4. "The Harmonic Bousfield Lattice,"  
(available on website)

### Research Lectures

1. "Comodule and Coalgebra Structure on Derived Quotients in  $\infty$ -categories," Topology Seminar, University of British Columbia, 2018
2. "An Operadic Approach to Noncommutative Geometry," Seattle Noncommutative Algebra Day – University of Washington, 2018
3. "Operads of Singular and Virtual Braids," AMS Spring Western Sectional Meeting – Special Session on Algebraic Topology, Portland 2018
4. "Toward Derived Hopf-Galois Extensions," Joint Mathematics Meetings – Special Session on Noncommutative Algebras and Noncommutative Invariant Theory, San Diego 2018
5. "Some Hopf-Galois Extensions in the Derived Setting," Seattle Noncommutative Algebra Day, University of Washington, 2017
6. "Structured Quotients of Ring Spectra and Obstructions to  $A_\infty$  Complex Orientations," The Transatlantic Transchromatic Homotopy Theory Conference, University of Regensburg, 2017
7. "A Third Isomorphism Theorem for Thom Spectra and Hopf-Galois Extensions," Category Theory Seminar, Macquarie University, 2017
8. "Graphical Spaces as a Model for Infinity Properads," Mathematics Seminar, University of Melbourne, 2017
9. "Iterated Quotients of Ring Spectra and Spectral Torsors," 58th Cascade Topology Seminar, University of British Columbia, 2017
10. "An Introduction to Thom Spectra and Hopf-Galois Extensions," Algebra Seminar, Temple University, 2017
11. "Iterated Thom Spectra with Examples," Topology Seminar, University of British Columbia, 2016

12. "Hopf-Galois Extensions of Ring Spectra and the Nilpotence Theorem," Topology Seminar, Ohio State University, 2015
13. "MU Without Manifolds," Topology Seminar, University of Chicago, 2015
14. "Hopf-Galois Extensions of Ring Spectra and the Nilpotence Theorem," Topology Seminar, University of Illinois Urbana-Champaign, 2015
15. "Thom Spectra and Coalgebraic Structure," Young Topologists' Meeting, École Polytechnique Fédérale de Lausanne, 2015
16. "Non-Commutative Bialgebras in Spectra and Hopf-Galois Extensions," Topology Seminar, Johns Hopkins University, 2015
17. "Non-Commutative Bialgebras in Spectra and Hopf-Galois Extensions," Graduate Student Topology and Geometry Conference, University of Illinois Urbana-Champaign, 2015
18. "Ravenel's  $X(n)$  Spectra as Iterated Hopf-Galois Extensions," Topology Seminar, University of Virginia, 2015
19. "Ravenel's  $X(n)$  Spectra as Iterated Hopf-Galois Extensions," Topology Seminar, Ohio State University, 2014
20. "A New Class of Hopf-Galois Extensions in Chromatic Homotopy Theory," Modular Invariants in Topology and Analysis, University of Regensburg, 2014
21. "Descent Cohomology and Twisted Forms in Homotopy Theory," Structured Ring Spectra and Their Invariants, University of Manchester, 2014

## Expository Lectures

1. "Symmetry, Topology and the Nobel Prize," lecture for high school students on topological phases of matter, given at the University of Washington's Math Day, 2018
2. "The Nerve, the Bar Construction and Classifying Spaces," several lectures given in J. Zhang's student seminar, University of Washington, 2018
3. "Simplicial Sets and Simplicial Homotopy Theory," several lectures given in J. Zhang's student seminar, University of Washington, 2017
4. "An Introduction to Operads," several lectures given in J. Zhang's student seminar, University of Washington, 2017
5. "An Introduction to Homotopy Theory," Current Topics Seminar, University of Washington, 2017
6. "Stabilization of  $\infty$ -categories," West Coast Algebraic Topology Student Seminar, University of Oregon, 2013

## Grants

1. NSF Grant, *Recent Developments in Noncommutative Algebra and Related Areas*, with James Zhang (DMS-1764210), \$21,920
2. NSF Grant, *2018 Young Topologists Meeting*, (DMS-1818905), \$30,000

## Awards

1. Nominee, University of Washington Postdoc Mentoring Award, 2018.
2. Phi Beta Kappa, Johns Hopkins University Chapter, 2016.
3. Hernandez Mathematics Award, University of Central Florida, 2010.

## Service

- Lead Acting Assistant Professor, University of Washington, 2018–2019
- Co-Organizer, *Young Topologists Meeting*, University of Copenhagen, 2018
- Co-organizer, *Recent Developments in Noncommutative Algebra and Related Areas*, University of Washington, 2018
- Co-organizer and Moderator, *Panel on Mental Health for Graduate Students in Math*, University of Washington, 2018
- Organizer, *AMS Special Session in Homotopy Theory*, University of California, Riverside, 2017
- Co-organizer, *Johns Hopkins Graduate Student Topology Seminar*, 2011–2016
- Referee, *Algebraic & Geometric Topology*, 2017–present
- Reviewer, *Mathematical Reviews*, 2017–present

## Advising

- Sebastian Gant, Undergraduate Thesis, “Reflective Subcategories of  $Top$ : Hausdorffization and the Like,” 2018

## Teaching

- Math 324–Advanced Multivariable Calculus, University of Washington, Fall 2018
- Math 300–Introduction to Mathematical Reasoning, Summer 2018
- Math 441–Topology, University of Washington, Summer 2018
- Math 443–Differential Geometry II, University of Washington, Spring 2018
- Math 442–Differential Geometry I, University of Washington, Winter 2018
- Math 324–Advanced Multivariable Calculus, University of Washington, Fall 2017
- Math 441–Topology, University of Washington, Summer 2017
- Math 301–Elementary Number Theory, University of Washington, Summer 2017
- Math 324–Advanced Multivariable Calculus, University of Washington, Spring 2017
- Math 324–Advanced Multivariable Calculus, University of Washington, Winter 2017
- Math 498–Independent Study in Topology, University of Washington, Winter 2017
- Math 308–Matrix Algebra, University of Washington, Fall 2016
- Math 202–Vector Calculus (Online), Johns Hopkins University, Summer 2015

- Math 109–Calculus II (Online), Johns Hopkins University, Summer 2014
- Math 202–Vector Calculus (Online), Johns Hopkins University, Summer 2013
- Math 109–Calculus II (Online), Johns Hopkins University, Summer 2012