

MARK JOSEPH BEHRENS

*Curriculum Vitae*

MIT Department of Mathematics  
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Degrees:

Ph.D., Mathematics, University of Chicago, 2003, Thesis Advisor: J. P. May  
M.A., Mathematics, University of Alabama at Tuscaloosa, 1998  
B.S., Mathematics, University of Alabama at Tuscaloosa, 1998  
B.S., Physics, University of Alabama at Tuscaloosa, 1998

Employment:

NSF Postdoctoral Fellow, Department of Mathematics, MIT, Supervisor: M. J. Hopkins  
Assistant Professor, Department of Mathematics, MIT, 2005-2011  
Visiting Scholar, Department of Mathematics, Harvard University, 2007-2008  
Associate Professor, Department of Mathematics, MIT, 2011-present

Honors:

Scholar, Barry M. Goldwater Scholarship and Excellence in Education Program, 1995  
Postdoctoral Fellow, NSF, 2003  
Fellow, Sloan Foundation, 2007  
Invited Address, 1044<sup>th</sup> meeting American Mathematical Society, 2008  
CAREER grant, NSF, 2011  
Cecil and Ida B. Green Career Development Associate Professorship, 2011  
MIT School of Science Teaching Prize for Graduate Education, 2011

UROP Students Supervised:

Hahn, Jeremy, summer, fall 2011, spring 2012  
Atsaves, Louis, spring, summer 2011  
Li, Yan, summer 2010  
Tynan, Phillip, summer 2010  
Lerner, Ben, spring 2010  
Sauter, Trace, summer 2009

Ph.D. Students Supervised:

Osorno, Angelica, An infinite loop space structure for K-theory of bimonoidal categories,  
2010, Dickson Instructor, University of Chicago  
French, Jennifer, Derived mapping spaces as models for localizations, 2010  
Pereira, Luis Alexandre, in progress  
Ullman, John, in progress

Postdoctoral Researchers Supervised:

Ormsby, Kyle, 2010-present  
Stapleton, Nathaniel, 2011-present  
Stojanoska, Vesna, 2011-present

Teaching Experience:

18.02A, Calculus lecture, fall 2011, IAP 2012  
18.02, Calculus recitation, fall 2003, spring 2007  
18.100A, Analysis I, spring 2007, spring 2009  
18.904, Seminar in Topology, fall 2005  
18.906, Algebraic Topology II, spring 2006, spring 2010, spring 2011, spring 2012  
18.915, Graduate Topology Seminar, fall 2006, fall 2009  
18.917, Topics in Algebraic Topology, fall 2008  
18.950, Differential Geometry, fall 2009

Service:

Graduate admissions committee, Department of Mathematics, 2005-2006, 2007-current  
Moore Instructor committee, Department of Mathematics, 2009-current  
Colloquium Committee, Department of Mathematics, 2009-current  
Diversity Committee, Department of Mathematics, 2010-current  
School of Science underrepresented minority strategic group, 2008-2010, 2012-current  
MSRP, Mentor: 2009, 2011, Math coordinator: 2011, faculty lecture, 2011  
Undergraduate academic advisor, Department of Mathematics, 2007-current  
Microteaching workshop, 2009-current  
IAP lecture, 2006, 2007  
SEPT program lecturer, 2006, 2009  
Participant in hooding ceremony, spring 2010  
Laureates and Leaders dinner, 2009, 2010  
MMBA mentorship dinner, 2010  
Graduate student lunch seminar, Speaker: spring 2008, fall 2008, fall 2009,  
Organizer: spring 2011  
Organizer: K-theory lunch seminar, spring 2009  
MAP mentor, 2010-2012  
IAP Directed reading program, coorganizer, 2011-present  
Freshman Advisor, 2011-2012  
UROP coordinator: pure mathematics, 2011-current

External Service:

Editor, *Advances in Mathematics*, 2011-current  
Reviewer, *AMS math reviews*, 2004-current

Publications:

1. *A new proof of the Bott periodicity theorem*, *Topology Appl.* 119 (2002), 167-183.
2. *Addendum to "A new proof of the Bott periodicity theorem"*, *Topology Appl.* 143 (2004), 281-290.

3. *On the existence of the self map  $v_2^9$  on the Smith-Toda complex  $V(1)$  at the prime 3*, with Satya Pemmaraju, Contemp. Math. 346 (2004), 9-49.
4. *Root invariants in the Adams spectral sequence*, Trans. Amer. Math. Soc. 358 (2006), 4279-4341.\*
5. *A modular description of the  $K(2)$ -local sphere at the prime 3*, Topology 45 (2006), 343-402.
6. *Isogenies of elliptic curves and the Morava stabilizer group*, with Tyler Lawson, J. of Pure Appl. Algebra 207 (2006), 37-49.
7. *Some root invariants at the prime 2*, Geom. Topol. Monographs 10 (2007), 1-40.
8. *Buildings, elliptic curves, and the  $K(2)$ -local sphere*, Amer. J. Math. 129 (2007) 1513-1563.
9. *On the existence of a  $v_2^{32}$ -self map on  $M(1,4)$  at the prime 2*, with Michael Hill, Michael J. Hopkins, and Mark Mahowald, Homology, Homotopy Appl. 10 (2008), 45-84.
10. *Congruences between modular forms given by the divided beta family in homotopy theory*, Geom. Topol. 13 (2009), 319-357.
11.  *$\beta$ -family congruences and the  $f$ -invariant*, with Gerd Laures, Geom. Topol. Monographs 16 (2009) 9-29.
12. *Topological automorphic forms*, with Tyler Lawson, Memoirs of the AMS. 958 (2010), i-xxiii, 1-132.
13. *The homotopy fixed point spectra of profinite Galois extensions*, with Daniel G. Davis, Trans. Amer. Math. Soc. 362 (2010) 4983-5042.
14. *Topological automorphic forms on  $U(1,1)$* , with Tyler Lawson, Math. Zeit. 267 (2011), 497-522.
15. *Higher real  $K$ -theories and topological automorphic forms*, with Michael J. Hopkins, J. Topology 4 (2011), 39-72.
16. *The Goodwillie tower for  $S^1$  and Kuhn's theorem*, Algebr. Geom. Topol. 11 (2011), 2453-2475.
17. *The homotopy groups of  $S_{E(2)}$  at  $p \geq 5$  revisited*, Adv. Math. 230 (2012), 458-492.

Submitted and In Progress Publications:

18. *Notes on the construction of  $tmf$* , to appear in proceedings of 2007 Talbot Workshop (50 pages).
19. *The EHP sequence and the Goodwillie tower*, to appear in Memoirs AMS (103 pages).
20. *The Bousfield-Kuhn functor and topological Andre-Quillen cohomology*, with Charles Rezk, in progress.
21. *Topological modular forms of level 5*, with Kyle Ormsby, in progress.
22. *The Hurewicz image of  $tmf$* , with Mark Mahowald, in progress.

Invited Presentations:

- Root invariants in the Adams spectral sequence*, Topology seminar, University of Illinois at Urbana-Champaign, 2002
- Root invariants and  $v_2$ -periodicity at the prime 3*, Topology seminar, University of Chicago, 2002
- Root invariants in the Adams spectral sequence*, Sectional meeting of the AMS, Orlando, FL, 2002
- On the homology of  $tmf$* , Topology seminar, University of Notre Dame, 2003
- Homotopy beta elements at the prime 3*, Northwestern University, 2003
- Isogenies of elliptic curves and the  $K(2)$ -local sphere*, Conference in honor of Goro Nishida, Kinoshita, Japan, 2003
- Lecture series on root invariants*, Workshop attached to Nishida conference, Nagoya, Japan, 2003
- Root invariants, Adams spectral sequences, and Greek letter elements*, Topology seminar, MIT, 2003
- Isogenies of elliptic curves and the  $K(2)$ -local sphere*, Topology seminar, University of Chicago, 2003
- A modular description of the  $K(2)$  local sphere*, MIT topology seminar, 2004
- A modular description of the  $K(2)$ -local sphere at the prime 3*, Special session on homotopy theory (in honor of William Browder's 70<sup>th</sup> birthday), Sectional meeting of the AMS, Lawrenceville, NJ, 2004

*Isogenies of elliptic curves and the  $K(2)$ -local sphere*, Workshop on forms of homotopy theory: elliptic cohomology and loop spaces, Fields Institute, 2004  
*Isogenies of elliptic curves and the  $K(2)$ -local sphere*, Topology/geometry seminar, Brown University, 2004  
*The  $K(2)$ -local sphere and isogenies of elliptic curves*, Topology seminar, Northwestern University, 2004  
*Stable homotopy groups of spheres and modular forms*, Wayne State University Colloquium, 2005  
*A resolution of the  $K(2)$ -local sphere*, Wayne State University Topology Seminar, 2005  
*A resolution of the  $K(2)$ -local sphere*, University of Rochester, 2005  
*Hypercohomology of categories*, Union College Mathematics Conference, Union College, 2005  
*Whitehead products and the Goodwillie tower*, Workshop on operads and the Goodwillie Calculus, Clay Mathematics Institute, 2005  
*Buildings, elliptic curves, and the  $K(2)$ -local sphere*, Topology seminar, University of Illinois at Urbana-Champaign, 2005  
*Buildings, elliptic curves, and the stable homotopy groups of spheres*, Topology seminar, Bonn, Germany, 2005  
*Buildings, elliptic curves, and the stable homotopy groups of spheres*, Joint meeting of AMS, DMV, OMG, Mainz, Germany, 2005  
*Computing homotopy groups of spheres with modular forms*, Colloquium, Purdue University, 2005  
*Hypercohomology of categories*, Topology seminar, Purdue university, 2005  
*The Eichler-Shimura correspondence for  $GL(2)$* , Talbot Workshop, North Conway, NH, 2005  
*Cohomology theories associated to Shimura varieties*, Topology seminar, MIT, 2005  
*Computing homotopy groups of spheres with modular forms*, Colloquium, University of Chicago, 2006  
*Cohomology theories associated to Shimura varieties*, Topology seminar, University of Chicago, 2006  
*Computing homotopy groups of spheres with modular forms*, Colloquium, University of Texas at Austin, 2006  
*Cohomology theories associated to Shimura varieties*, Seminar, University of Texas at Austin, 2006  
*Computing homotopy groups of spheres with modular forms*, Colloquium, Johns Hopkins University, 2006  
 *$v_2$ -periodicity at the prime 2*, Algebraic and Geometric Topology: a conference in honor of Bob Stong, University of Virginia, 2007  
*Stable homotopy groups of spheres and modular forms*, Harvard faculty colloquium, Harvard University, 2007  
*Topological automorphic forms*, Workshop on stacks in geometry and topology, Fields Institute, 2007  
*On the construction of  $tmf$* , Talbot workshop, North Conway, NH, 2007  
*Topological automorphic forms*, Complex cobordism in homotopy theory: its impacts and prospects, Johns Hopkins University, 2007  
*Topological automorphic forms*, Abel Symposium, Oslo, Norway, 2007  
*Lecture series on topological automorphic forms*, Nagoya Institute of Technology, Nagoya, Japan, 2008  
*Wrapping spheres around spheres*, General lecture, Nagoya Institute of Technology, Nagoya, Japan, 2008  
*Congruences amongst modular forms and the divided beta family*, Special session on algebraic topology, Joint meetings of the AMS, San Diego, CA, 2008  
*Congruences amongst modular forms and periodic families of elements in the stable homotopy groups of spheres*, Boston University number theory seminar, 2008

*On the existence of a  $v_2^{32}$  self-map at the prime 2*, Special session on applications of ring spectra, Sectional meeting of the AMS, Bloomington, IN, 2008  
*Discussion sessions*, Homotopical group theory and topological algebraic geometry workshop, University of Copenhagen, Denmark, 2008  
*Congruences amongst modular forms and the divided beta family*, Homotopical group theory and topological algebraic geometry, Bonn, Germany, 2008  
*Homotopy fixed points of profinite Galois extensions*, MIT topology seminar, 2008  
*Congruences between modular forms and the divided beta family*, Wayne State University Topology Seminar, 2008  
*Congruences amongst modular forms and the stable homotopy groups of spheres*, Invited address, 1044<sup>th</sup> meeting of the AMS, Huntsville, AL, 2008  
*Modular forms and topology*, Graduate student colloquium, Northwestern University, 2008  
*Orientations and Eisenstein series*, Topology seminar, University of Minnesota, 2008  
*Orientations and Eisenstein series*, Number theory seminar, Harvard University, 2008  
*Orientation theory*, Topology Seminar, Hebrew University of Jerusalem, Jerusalem, Israel, 2009  
*Lecture series on topological modular forms*, Workshop in homotopy theory on topological modular forms, Caesarea Maritime Center, Caesarea, Israel, 2009  
*Orientations and Eisenstein series*, Topology seminar, Berkeley University, 2009  
*Orientations and Eisenstein series*, Topology seminar, Johns Hopkins University, 2009  
*Modular forms in topology*, Colloquium, Tufts University, 2009  
*Chromatic fracture of  $gl_1$* , Mini-FRG on p-divisible groups and stable homotopy theory, 2009  
*On the relationship between  $EO_n$  and TAF*, Eastern Section Meeting of the AMS, University Park, Penn State University, 2009  
*Higher real K-theories and topological automorphic forms*, Topology seminar, University of British Columbia, 2010  
*Higher real K-theories and topological automorphic forms*, Midwest Topology Seminar, Michigan University, 2010  
*The homotopy groups of the  $E(2)$ -local sphere, revisited*, Topology seminar, MIT, 2010  
*The EHP sequence and the Goodwillie tower*, Georgia topology conference, Athens, GA, 2010  
*The homotopy groups of the  $E(2)$ -local sphere, revisited*, Conference on homotopy theory and derived algebraic geometry, Fields Institute, 2010  
*Introduction to the Adams-Novikov Spectral Sequence: Ravenel's Proof for Primes  $> 3$* , Hot topics workshop on the Kervaire invariant, MSRI, 2010  
*The homotopy groups of the  $E(2)$ -local sphere, revisited*, Topology seminar, CUNY graduate center, 2010  
*The EHP sequence and the Goodwillie tower*, Algebraic topology seminar, Princeton, 2010  
*The Goodwillie tower and the Whitehead conjecture*, Topology seminar, UIUC, 2011  
*The Goodwillie tower and the Whitehead conjecture*, Topology seminar, Univ. of Chicago, 2011  
*A survey of the Goodwillie tower of the identity*, Workshop on functor calculus and operads, BIRS, 2011  
*The odd primary EHP sequence*, Union mathematics conference, 2011  
*XII Lisbon Summer Lectures in Geometry: Topological Automorphic Forms*, Instituto Superior Técnico, Lisbon, Portugal, 2011  
*Congruences between modular forms and the divided  $\beta$  family*, MSRP faculty lecture, MIT, 2011  
*The Morava E-homology of the  $L(k)$  spectra*, Topology summer seminar, MIT, 2011  
*Homological behavior of the Goodwillie tower*, Workshop on homotopy theory, MFO, 2011  
*The Morava E-theory of the Goodwillie tower*, Special session on calculus of functors, JMM, Boston, 2012  
*Exotic spheres and topological modular forms*, Second Abel Conference: A Mathematical Celebration of John Milnor, IMA, 2012  
*The Morava E-theory of the Goodwillie tower*, Topology seminar, University of Chicago, 2012  
*Exotic spheres and topological modular forms*, Midwest topology seminar, Northwestern, 2012

Research Contracts and Grants:

- NSF, CAREER: Arithmetic structure of homotopy theory, 7/1/2011-current, \$52,034.00.
- NSF, Collaborative Research: Homotopy theory: Applications and new dimensions (with H. Miller, C. Barwick, M. J. Hopkins, J. Lurie), 9/1/2009-current, \$726,570.00
- NSF, EMSW21-RTG: Geometry and topology (with T. Mrowka, D. Auroux, P. Seidel, K. Wehrheim), 6/2010-current, \$672,940.00
- NSF, Conference grant: Current and classical themes in homotopy theory, 7/2009-7/2010, \$25,000.00
- MIT, NEC Corporation fund for research in computers and communications, 2008, \$50,000
- Alfred P. Sloan foundation, Research fellowship, 7/2007-9/2011, \$45,000.00
- NSF, Local and global methods in homotopy theory, 7/2006-6/2010, \$139,445.00
- NSF, Postdoctoral fellowship, 7/2003-6/2006, \$108,000.00