

# **CURRICULUM VITAE FOR MATTHEW BAKER**

May 2017

School of Mathematics  
Georgia Institute of Technology  
Atlanta, GA 30332-0160, USA  
e-mail: mbaker@math.gatech.edu

## **POSITIONS HELD:**

- Georgia Institute of Technology (Fall 2011 – Present) Professor
- University of California Berkeley (Fall 2011 – Spring 2012) Professor
- Georgia Institute of Technology (Fall 2007 – Present) Associate Professor
- Georgia Institute of Technology (Fall 2004 – Summer 2007) Assistant Professor
- University of Georgia (Fall 2002 – Summer 2004) Assistant Professor
- University of Paris 7 (Summer 2003) Visiting Professor
- Harvard University (Fall 2000 – Summer 2002) Benjamin Peirce Assistant Professor
- Harvard University (Fall 1999 – Summer 2000) NSF Postdoctoral Fellow

## **EDUCATION:**

- Ph. D., Mathematics, University of California at Berkeley (1999)
- B. S., Mathematics, University of Maryland at College Park (1994),  
summa cum laude with highest honors

## **DISSERTATION:**

- Torsion Points on Modular Curves (Advisor: Robert Coleman)

## **RESEARCH GRANTS:**

- NSF Research Grant DMS-1529573 (2015–2018)
- NSF Research Grant DMS-1201473 (2012–2015)
- NSF Research Grant DMS-0901487 (2009 – 2012)
- NSF Research Grant DMS-0600027 (2006 – 2009)
- NSF Research Grant DMS-0300784, joint with Robert Rumely (2003 – 2006)

## **HONORS, AWARDS, AND FELLOWSHIPS:**

- Simons Fellowship in Mathematics (2017–2018)
- Fellow of the American Mathematical Society (2012 – Present)
- University System of Georgia Board of Regents Teaching Excellence Award (2010)
- Georgia Tech CETL/BP Junior Faculty Teaching Award (2007)
- Georgia Tech Class of 1969 Teaching Fellowship (2004)
- NSF Postdoctoral Research Fellowship (1999 – 2003)
- Alfred P. Sloan Dissertation Fellowship (1998 – 1999)
- Simons Foundation Award for Excellence in Mathematics (1997)
- Department of Defense NDSEG Graduate Fellowship (1995 – 1998)

## BOOKS:

- (1) Nonarchimedean and Tropical Geometry, with Sam Payne (editors), Simons Symposia, Springer-Verlag, 2016.
- (2) Tropical and Non-Archimedean Geometry, with Omid Amini and Xander Faber (editors), Contemporary Mathematics **605**, 2013.
- (3) Potential Theory and Dynamics on the Berkovich Projective Line, with Robert Rumely, Mathematical Surveys and Monographs **159**, American Mathematical Society, 2010 (428 pages).

## RESEARCH PAPERS:

- (1) The Bernardi Process and Torsor Structures on Spanning Trees, with Yao Wang, *International Math. Research Notices* (2017).
- (2) Weight Functions on Berkovich Curves, with Johannes Nicaise, *Algebra & Number Theory* **10** (2016), 2053–2079.
- (3) Nonarchimedean Geometry, Tropicalization, and Metrics on Curves, with Sam Payne and Joseph Rabinoff, *Algebraic Geometry* **3**, no. 1 (2016), 63–105.
- (4) Bitangents of Tropical Plane Quartic Curves, with Yoav Len, Ralph Morrison, Nathan Pflueger, and Qingchun Ren, *Mathematische Zeitschrift* **282**, no. 3 (2016), 1017–1031.
- (5) Degeneration of Linear Series From the Tropical Point of View and Applications, with David Jensen, in *Nonarchimedean and Tropical Geometry* (edited with Sam Payne), Simons Symposia, Springer-Verlag, 2016.
- (6) The Skeleton of the Jacobian, the Jacobian of the Skeleton, and Lifting Meromorphic Functions from Tropical to Algebraic Curves, with Joseph Rabinoff, *International Math. Research Notices* **16** (2015), 7436–7472.
- (7) Robert F. Coleman: 1954–2014, with Barry Mazur and Ken Ribet, *Research in the Mathematical Sciences* **2** (2015) 2:21.
- (8) Lifting Harmonic Morphisms I: Metrized Complexes and Berkovich Skeleta, with Omid Amini, Erwan Brugalle, and Joseph Rabinoff, *Research in the Mathematical Sciences* **2** (2015), Art. 7, 67 pp.
- (9) Lifting Harmonic Morphisms II: Tropical Curves, with Omid Amini, Erwan Brugalle, and Joseph Rabinoff, *Algebra & Number Theory* **9**, no. 2 (2015), 267–315.
- (10) Linear Series on Metrized Complexes of Algebraic Curves, with Omid Amini, *Mathematische Annalen* **362**, no. 1-2 (2015), 55–106.
- (11) Canonical Representatives for Divisor Classes on Tropical Curves and the Matrix-Tree Theorem, with Yang An, Greg Kuperberg, and Farbod Shokrieh, *Forum of Mathematics, Sigma* **2** (2014), e24, 25 pages.
- (12) Special Curves and Postcritically-Finite Polynomials, with Laura DeMarco, *Forum of Mathematics, Pi* **1** (2013), e3, 35 pages.
- (13) On the Structure of Non-Archimedean Analytic Curves, with Joseph Rabinoff and Sam Payne, *Contemporary Mathematics* **605** (2013), 93–121.
- (14) Chip Firing Games, Potential Theory on Graphs, and Spanning Trees, with Farbod Shokrieh, *J. Combinatorial Theory Series A*. **120**, no. 1 (2013), 164–182.
- (15) Preperiodic Points and Unlikely Intersections, with Laura DeMarco, *Duke Math. J.* **159**, no. 1 (2011), 1–29.
- (16) Metric Properties of the Tropical Abel-Jacobi Map, with Xander Faber, *Journal of Algebraic Combinatorics* **33**, no. 3 (2011), 349–381.

- (17) Harmonic Morphisms and Hyperelliptic Graphs, with Serguei Norine, *International Math. Research Notices* **15** (2009), 2914–2955.
- (18) A Finiteness Theorem for Canonical Heights Attached to Rational Maps over Function Fields, *J. Reine Angew. Math.* **626** (2009), 205–233.
- (19) Specialization of Linear Systems from Curves to Graphs, *Algebra & Number Theory* **2**, no. 6 (2008), 613–653.
- (20) A Finiteness Property of Torsion Points, with Su-ion Ih and Robert Rumely, *Algebra & Number Theory* **2**, no. 2 (2008), 217–248.
- (21) An Introduction to Berkovich Analytic Spaces and Non-Archimedean Potential Theory on Curves, in *p-adic Geometry* (Lectures from the 2007 Arizona Winter School), AMS University Lecture Series, 2008.
- (22) Uncountable Sets and an Infinite Real Number Game, *Mathematics Magazine* **80**, no.5 (December 2007), 377–380.
- (23) Riemann-Roch and Abel-Jacobi Theory on a Finite Graph, with Serguei Norine, *Advances in Mathematics* **215** (2007), 766–788.
- (24) Harmonic Analysis on Metrized Graphs, with Robert Rumely, *Canad. J. Math.* **59**, no. 2 (2007), 225–275.
- (25) A Lower Bound for Average Values of Dynamical Green’s Functions, *Mathematical Research Letters* **13**, no. 2 (2006), 245–257.
- (26) Equidistribution of Small Points, Rational Dynamics, and Potential Theory, with Robert Rumely, *Ann. Inst. Fourier (Grenoble)* **56**, no. 3 (2006), 625–688.
- (27) Metrized Graphs, Laplacian Operators, and Electrical Networks, with Xander Faber, *Contemporary Mathematics* **415**, Proceedings of the Joint Summer Research Conference on Quantum Graphs and Their Applications, Snowbird, Utah, 2006.
- (28) Global Discrepancy and Small Points on Elliptic Curves, with Clayton Petsche, *International Math. Research Notices* **61** (2005), 3791–3834.
- (29) Finiteness Results for Modular Curves of Genus at Least 2, with Enrique González-Jiménez, Josep González, and Bjorn Poonen, *Amer. J. Math.* **127**, no. 6 (2005), pp. 1325–1387.
- (30) Canonical Heights, Transfinite Diameters, and Polynomial Dynamics, with Liang-Chung Hsia, *J. Reine Angew. Math.* **585** (2005), 61–92.
- (31) Equidistribution of Small Subvarieties of Abelian Varieties, with Su-ion Ih, *New York J. Math.* **10** (2004), pp. 279–285.
- (32) A Lower Bound for the Canonical Height on Abelian Varieties over Abelian Extensions, with Joseph Silverman, *Mathematical Research Letters* **11** (2004), 377–396.
- (33) Torsion Points on Curves and Galois Theory, with Ken Ribet, Les XXIIèmes Journées Arithmétiques (Lille, France), *Journal de Théorie des Nombres de Bordeaux* **15** (2003), pp. 11–32.
- (34) Lower Bounds for the Canonical Height on Elliptic Curves over Abelian Extensions, *International Math. Research Notices* **29** (2003), pp. 1571–1589.
- (35) Automorphisms of  $X_0^*(p)$ , with Yuji Hasegawa, *Journal of Number Theory* **100**, no. 1 (2003), pp. 72–87.
- (36) Torsion Packets on Curves, with Bjorn Poonen, *Compositio Math.* **127** (2001), pp. 109–116.
- (37) Torsion Points on Modular Curves, *Inventiones Math.* **140** (2000), pp. 487–509.

- (38) Cartier Points on Curves, *International Math. Research Notices* **7** (2000), pp. 353–370.
- (39) Kamienny’s Criterion and the Method of Coleman and Chabauty, *Proceedings of the A.M.S.* **127**, no. 10 (1999), pp. 2851–2856.

#### PREPRINTS:

- (1) Hodge theory in combinatorics, preprint available at [arXiv:1705.07960](https://arxiv.org/abs/1705.07960).
- (2) Matroids over Hyperfields, with Nathan Bowler, preprint available at [arXiv:1601.01204](https://arxiv.org/abs/1601.01204).
- (3) Geometric Bijections for Regular Matroids, Zonotopes, and Ehrhart Theory, with Spencer Backman and Chi Ho Yuen, preprint available at [arXiv:1701.01051](https://arxiv.org/abs/1701.01051).

#### MATHEMATICS BLOG:

<http://mattbakerblog.wordpress.com/>

#### SELECTED DEPARTMENTAL SERVICE:

- Director of Undergraduate Studies for the Georgia Tech School of Mathematics (2015–Present)
- Georgia Tech School of Mathematics Salary & Awards Committee (2014)
- Georgia Tech School of Mathematics Undergraduate Committee (2013–Present)
- Georgia Tech School of Mathematics Communication, Development, and Outreach Committee (2013–2015)
- Georgia Tech School of Mathematics Putnam Exam Coordinator (2006–2010, 2012–2015)
- Georgia Tech mathematics department Strategic Hiring Plan Committee (2009–2010)
- Georgia Tech mathematics department Hiring Committee (2009–2010)
- Georgia Tech mathematics department Chair Search Committee (2007–2008)
- Georgia Tech mathematics department Graduate Committee (2006–2009)
- Georgia Tech mathematics department REU coordinator (2005–2006, 2008–2010)

#### SELECTED PROFESSIONAL SERVICE:

- Co-organizer (with Sam Payne) of Simons Symposium on Tropical and Non-Archimedean Geometry in Krün, Germany (May 2017).
- Co-organizer (with Sam Payne) of MSRI Summer School on Chip Firing and Tropical Curves (July–August 2016)
- Co-organizer (with David Jensen and Sam Payne) of BIRS workshop on Algebraic, Tropical, and Nonarchimedean Analytic Geometry of Moduli Spaces, Oaxaca, Mexico (May 2016)
- Co-organizer (with Joe Silverman) of AMS Special Session on Arithmetic Dynamics at the AMS–MAA Joint Meetings, Seattle WA (January 2016)
- Member of the AMS Fellows Selection Committee (2015–2016)
- Member of the AMS Committee on Education (2015–Present)
- Member of the AMS Council (2015–Present)
- Lead organizer (with Kiran Kedlaya, Ken Ribet, Richard Taylor, and Annette Werner) of conference on  $p$ -adic Methods in Number Theory in honor of Robert F. Coleman, Berkeley CA (May 2015)

- Principle Guest Editor for a special volume of *Research in the Mathematical Sciences* in honor of Robert F. Coleman
- Co-organizer (with Sam Payne) of Simons Symposium on Tropical and Non-Archimedean Geometry in Rio Grande, Puerto Rico (February 2015)
- Editor for *Research in Number Theory* (2014–Present)
- Co-organizer (with Angie Cueto, Eric Katz, and Sam Payne) of BIRS workshop on Specialization of Linear Series for Tropical and Algebraic Curves, Banff International Research Station (March 2014)
- Co-organizer (with Sam Payne) of AMS Mathematical Research Communities program in Snowbird, Utah (June 2013)
- Co-organizer (with Sam Payne) of Simons Symposium on Tropical and Non-Archimedean Geometry in St. John, U.S. Virgin Islands (March 2013)
- Served on NSF grant panels (Fall 2016, Spring 2013, Spring 2011, Fall 2007, Fall 2003)

#### SELECTED RECENT PLENARY TALKS AND LECTURE SERIES:

- *Tropical linear series*, Mini-course at summer school on Berkovich spaces, tropical geometry, and model theory in Bogota, Colombia, July 2017 (forthcoming).
- *Hodge theory in combinatorics*, Plenary talk, AMS Current Events Bulletin, AMS/MAA Joint Meetings, January 2017.
- *The secret life of graphs*, Plenary talk, Benjamin Peirce Centennial Conference, Harvard University, Summer 2016.
- *Lower bounds for dynamical Green functions and applications*, Plenary talk, Silvermania Conference, Brown University, Summer 2015.
- *Tropical Jacobians and the Zhang measure on Berkovich curves*, Plenary talk, Conference on Non-Archimedean Geometry and its Applications, University of Michigan, Summer 2015.
- *Specialization of linear series from curves to graphs*, 4.5-hour mini-course at IMPA, Rio de Janeiro, Brazil, Summer 2015.
- *Tropical geometry and torsor structures on spanning trees*, Plenary talk, Triangle Lectures in Combinatorics, NC State, Spring 2015.
- *Riemann-Roch for graphs and applications*, Plenary talk, Southern California Number Theory Day, Caltech, Spring 2014.
- *Metriized complexes of curves*, Plenary talk, Western Algebraic Geometry Seminar, University of Utah, Fall 2012.
- *Linear series on metriized complexes of curves*, Plenary talk, Conference in honor of Lucien Szpiro's birthday at the CUNY Graduate Center, Summer 2012.
- *Tropical and non-archimedean geometry*, Four two-hour lectures as the Principal Speaker at the Bellairs Workshop in Number Theory, Barbados, Summer 2011.

#### OTHER SELECTED INVITED TALKS:

- Spring 2017, Colloquium talk at University of Rochester
- Fall 2016, Colloquium talk at Rice University
- Spring 2015, Algebraic geometry seminar talk at Duke University
- Summer 2014, Second ERC Research Period on Diophantine Geometry, Cetraro, Italy
- Spring 2014, Colloquium talk at University of South Carolina

- Spring 2014, New York Number Theory Seminar, CUNY Graduate Center
- Spring 2014, AMS Special Session at the Joint Math Meetings, Baltimore, MD
- Fall 2013, ARC 6 conference at Georgia Tech
- Fall 2013, Clemson Discrete Math conference
- Fall 2013, Colloquium talk at University of Wisconsin, Madison
- Fall 2013, Algebraic geometry seminar talk at University of Wisconsin, Madison
- Summer 2013, AIM workshop on Generalizations of Chip Firing
- Spring 2013, Colloquium talk at Princeton University
- Spring 2013, Algebraic Geometry Seminar talk at Princeton University
- Fall 2012, Workshop on Berkovich Spaces in Oberwolfach, Germany
- Summer 2012, Colloquium talk at UC Santa Cruz, Santa Cruz, CA