

# Dhruv Ranganathan

*curriculum vitae*

MIT Building 2  
77 Massachusetts Avenue  
Cambridge, MA 02139  
☎ +1 (203) 589 3746  
✉ dhruvr@mit.edu  
🌐 www.dhruvrnathan.net

## Education

- May 2016 **Ph.D in Mathematics**, *Yale University*, New Haven, CT, USA.  
Thesis: Skeletons, degenerations, and Gromov–Witten theory.  
Advisor: Sam Payne
- May 2012 **B.Sc. in Mathematics**, *Harvey Mudd College*, Claremont, CA, USA.  
Graduated with highest distinction and honours in mathematics.  
Thesis: Gromov–Witten theory of blowups of toric threefolds.  
Advisor: Dagan Karp

## Academic Positions

- 2016–2018 C.L.E. Moore Instructor, Massachusetts Institute of Technology.  
2017 Member, Institute for Advanced Study, Program on Homological Mirror Symmetry.

## Research Interests

Algebraic geometry and combinatorics. Specifically, tropical and logarithmic geometry with applications to moduli spaces, Gromov–Witten theory, Brill–Noether theory.

## Publications

*Papers are available at arXiv at [https://arxiv.org/a/ranganathan\\_d\\_1](https://arxiv.org/a/ranganathan_d_1).*

- 2017 **Motivic Hilbert zeta functions of curves**,  
*with D. Bejleri and R. Vakil*. To appear in *Journal of the Institute of Mathematics Jussieu*.
- 2016 **Logarithmic Picard groups, chip firing, and the combinatorial rank**,  
*with T. Foster, M. Talpo, and M. Ulirsch*. To appear in *Mathematische Zeitschrift*.
- 2016 **Skeletons of stable maps II: superabundant geometries**,  
*Research in the Mathematical Sciences* 2017 4:11.
- 2016 **A graphical interface for the Gromov–Witten theory of curves**,  
*with R. Cavalieri, H. Markwig, and P. Johnson*. To appear in the *Proceedings of the 2015 Algebraic Geometry Summer Institute*.
- 2016 **A note on Brill–Noether existence for graphs of low genus**,  
*with S. Atanasov*. To appear in *Michigan Mathematical Journal*.
- 2015 **Enumerative geometry of elliptic curves on toric surfaces**,  
*with Y. Len*. To appear in *Israel Journal of Mathematics*.
- 2015 **Skeletons of stable maps I: rational curves in toric varieties**.  
*Journal of the London Mathematical Society* (2017) 95(3): 804–832.

- 2015 **Degenerations of toric varieties over valuation rings**,  
with *T. Foster*. Bulletin of the London Mathematical Society (2016) 48(5): 835-847.
- 2015 **Superabundant curves and the Artin fan**,  
International Mathematics Research Notices (2017) 2017(4): 1103-1115.
- 2015 **Hahn analytification and the connectivity of higher rank tropical varieties**,  
with *T. Foster*. manuscripta mathematica 151(3) (2016), 353-374
- 2014 **Tropical compactification and the Gromov–Witten theory of  $\mathbb{P}^1$** ,  
with *R. Cavalieri* and *H. Markwig*. Selecta Mathematica (2017) 23(2) 1027-1060.
- 2014 **Moduli spaces of rational weighted stable curves and tropical geometry**,  
with *R. Cavalieri*, *S. Hampe*, and *H. Markwig*. Forum of Mathematics, Sigma, Vol. 4, 2016.
- 2014 **Tropicalizing the space of admissible covers**,  
with *R. Cavalieri* and *H. Markwig*. Mathematische Annalen (2016) 364 1275-1313.
- 2014 **Realization of groups with pairing as Jacobians of finite graphs**,  
with *L. Gaudet*, *D. Jensen*, *N. Wawrykow*, and *T. Weisman*. To appear in Annals of Combinatorics.
- 2014 **Toric graph associahedra and compactifications of  $M_{0,n}$** ,  
with *R.F. da Rosa* and *D. Dave Jensen*. Journal of Algebraic Combinatorics (2016) 43 139-151.
- 2013 **Brill–Noether theory of maximally symmetric graphs**,  
with *T. Leake*. European Journal of Combinatorics (2015) 46 115-125.
- 2011 **Gromov–Witten theory of  $\mathbb{P}^1 \times \mathbb{P}^1 \times \mathbb{P}^1$** ,  
with *D. Karp*. Journal of Pure and Applied Algebra 220(8), 3000-3009.
- 2011 **Toric Symmetry of  $\mathbb{C}\mathbb{P}^3$** ,  
with *D. Karp*, *P. Riggins*, and *U. Whitcher*. Advances in Theoretical and Mathematical Physics (2012) 4 1291-1314.

### Papers under review

- 2017 **Moduli of stable maps in genus one & logarithmic geometry II**,  
with *K. Santos-Parker* and *J. Wise*. Submitted.
- 2017 **Moduli of stable maps in genus one & logarithmic geometry I**,  
with *K. Santos-Parker* and *J. Wise*. Submitted.
- 2017 **Incidence geometry and universality in the tropical plane**,  
with *M. Brandt*, *M. Jones*, and *C. Lee*. Submitted.
- 2017 **Topology of tropical moduli spaces of weighted stable curves**,  
with *A. Cerbu*, *S. Marcus*, *L. Peilen*, and *A. Salmon*. Submitted.
- 2017 **Counting curves on surfaces: tropical geometry & the Fock space**,  
with *R. Cavalieri*, *P. Johnson*, and *H. Markwig*. Submitted.
- 2017 **Brill–Noether theory for curves of a fixed gonality**,  
with *D. Jensen*. Submitted.

### Awards and Fellowships

- 2016 Marsden Fellowship, Fields Institute, Declined

- 2015 McDougal Teaching Fellow, Yale Center for Teaching and Learning
- 2014 Oberwolfach "Research-in-Pairs" in Fall 2015, with Cavalieri, Johnson, and Markwig
- 2013 Honorable Mention, AMS-MAA-SIAM Morgan Prize for Undergraduate Research

## Research Talks

**Over 60 conference and seminar talks since 2013 at institutions that include:** American Institute of Mathematics, Brown University, BIRS Casa Mathematica Oaxaca, University of Cambridge, Columbia University, Fields Institute, Harvard, Instituto Nacional de Matematica Pura e Aplicada, Imperial College London, Institute for Advanced Study, Institut Mittag-Leffler, MIT, Mathematical Sciences Research Institute, University of Michigan, New York University, Stockholm University, The Ohio State University, University of Colorado, University of Illinois, University of Pennsylvania, Princeton University, Rutgers University, Stanford University, University of Tennessee, University of Warwick, Yale University.

**A complete list of talks is available upon request.**

## Undergraduate Students

I have supervised over 20 undergraduate research students including summer projects, directed research during the term, and senior theses. These have led to six coauthored publications.

More information, including project descriptions, links to papers, and a list of students is available at <http://www.dhruvrnathan.net/undergraduate-research>.

## Other students

- Ongoing Andy Fry, Master's and Ph.D. theses, Colorado State University. Co-advised with Renzo Cavalieri.
- Ongoing Elizabeth Euwart and Anna Rasmussen. High school students, MIT PRIMES-Circle. Reading course in combinatorics.
- 2017 Jeffery Yu on Jacobians of finite graphs. High school student, MIT PRIMES-USA.

## Teaching

- Spring 2018 Abstract Algebra II, Massachusetts Institute of Technology.
- March 2018 Curve counting and tropical geometry, IMPA, Brazil.
- Fall 2017 Undergraduate Arithmetic Geometry, Massachusetts Institute of Technology.
- Summer 2017 Tropical curve counting and moduli, Stockholm University, Sweden.
- Spring 2016 Calculus II, Yale University.

## Teaching Development Workshops

*In 2015-16 I served as a fellow for the Yale Center for Teaching and Learning and provided consultations for a several graduate student instructors in various disciplines. I led the following workshops.*

- Spring 2016 Scientific Teaching Workshop in Anthropology, with Kaury Kucera and Julie Park.
- Spring 2016 Teaching Quantitative Reasoning Series, with Jared Rovny.

- Fall 2015 Fundamentals of Teaching Mathematics, with Stefan Avery.
- Fall 2015 Fundamentals of Teaching Physics, with Jared Rovny.

## Conferences and Seminars Organized

- Fall 2017 Harvard/MIT Algebraic Geometry Seminar (with Engel, Oberdieck, and Ullery)
- Spring 2017 The 'BATMOBYLE': Biannual Algebraic and Tropical Meetings Of Brown and Yale.  
Co-organized at Brown with D. Abramovich, K.Ascher, M. Chan, and B. Hassett.
- Fall 2016 Seminar on Topics in Arithmetic, Geometry, Etc (with Bjorn Poonen), MIT.
- January 2016 The Spring Teaching at Yale Day. An event to orient first-time teaching fellows to the culture of Yale's undergraduate experience, and participate in a dialogue that will explore the expectations of Yale students and instructors.
- May 2014 Student Tropical Algebraic Geometry Symposium (with Yoav Len), Yale University.  
This was the first student conference in tropical geometry in the United States, and attracted over 30 participants from 5 countries.

## Mentorship & Outreach

**Undergraduate Research.** In 2017 I was a coordinator for SUMRY REU program at Yale which consisted of six small teams of 19 students in total. In addition I worked directly with two groups. During the summers 2013-16 I supervised a total of 11 students in five projects.

**Highschool Research: PRIMES Program.** During the calendar year 2017 I was a faculty sponsor for the PRIMES research program run by MIT for highschool students across the USA, directly supervising one student. During 2018 I will be a mentor for a group of students in the PRIMES Circle program, which aims to increase diversity in the mathematical community by helping strong students from underrepresented groups to develop their interest in mathematics and to set them on a path toward pursuing a math-based major in college.

**Public School Outreach** In 2014 and 2015, together with Zlatko Minev and Christian Watkins, I organized a monthly science outreach program for low-income middle and high school students in the New Haven public school district. This was run in conjunction with Yale University's larger *Pathways to Science* program. I have run a number of discovery-based learning sessions in mathematics for middle and high school students.

## Service

Freshman advisor, 2017-18, Academic advisor, 2017-18, MIT.

Referee for *Advances in Mathematics*, *Compositio Mathematica*, *Geometry & Topology*, *International Mathematics Research Notices*, *Journal of Differential Geometry*, *Journal of the European Mathematical Society*, *Mathematische Annalen*, *Proceedings of the London Mathematical Society*, *Selecta Mathematica*, etc.

Ph.D. committee: Ashwin Deopurkar (Columbia), Keli Santos-Parker (University of Colorado). Undergraduate thesis committee: Shiyue Li, Harvey Mudd College, Siddarth Kanna, Pomona College.

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## References

**Advisor** Sam Payne, Yale University.  
Dan Abramovich, Brown University.  
Matt Baker, Georgia Institute of Technology.  
Davesh Maulik, Massachusetts Institute of Technology.  
Ravi Vakil, Stanford University.

**Teaching** Steffen Marcus, The College of New Jersey.