

# Dhruv Ranganathan

*curriculum vitae*

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## 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

- Fall 2016– C.L.E. Moore Instructor, Massachusetts Institute of Technology.  
Spring 2017 Member, Institute for Advanced Study, Program on Homological Mirror Symmetry.  
Spring 2015 Visiting Student, Department of Mathematics, Brown University.

## Research Interests

Algebraic geometry and combinatorics. Specifically, non-archimedean logarithmic and tropical geometry, moduli spaces, enumerative geometry, Brill–Noether theory.

## Publications

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

- 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 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 **Topology of tropical moduli spaces of weighted stable curves**,  
with *A. Cerbu, S. Marcus, L. Peilen, and A. Salmon*. Submitted.
- 2017 **Incidence geometry and universality in the tropical plane**,  
with *M. Brandt, M. Jones, and C. Lee*. Submitted.
- 2017 **Motivic Hilbert zeta functions of curves**,  
with *D. Bejleri and R. Vakil*. Preprint.
- 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
- 2014 Dean’s Grant for Symposia for S.T.A.G.S, co-PI with Yoav Len
- 2013 Honorable Mention, AMS-MAA-SIAM Morgan Prize for Undergraduate Research
- 2011 Giovanni Borrelli Research Grant, Harvey Mudd College
- 2009-12 James, Borrelli, and Chavin Prizes, Harvey Mudd College
- 2007 Gold Medal, A.I.S.M.T.A Mathematics Olympiad

## Research Talks

**Over 40 conference and seminar talks since 2013 at institutions that include:** American Institute of Mathematics, Boston University, Brown, BIRS Casa Mathematica Oaxaca, Colorado State University, Columbia, Fields Institute, Georgia Institute of Technology, Harvard, Institute for Advanced Study, University of Kentucky, University of Maryland, University of Massachusetts in Amherst, Mathematical Sciences Research Institute (Berkeley), University of Michigan, New York University, Northeastern University, Stockholm University, The College of New Jersey, The Ohio State University, University of Colorado, University of Illinois in Chicago, University of Pennsylvania, Princeton University, University of Saarlandes, Stanford University, University of Tennessee, University of Waterloo, Yale University.

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

## Undergraduate Students

- Summer 2013 Timothy Leake on the Brill–Noether theory of maximally symmetric graphs. Co-advised with Sam Payne.
- Summer 2014 Rodrigo Ferreira da Rosa on Hassett spaces, graph associahedra, and toric geometry.
- Summer 2014 Louis Gaudet, Nick Wawrykow, and Teddy Weisman on realizations of groups as Jacobians of finite graphs. Co-advised with Dan Corey and Dave Jensen.
- Summer 2014 Andrew Deveau, Jenna Kainic, and Dan Mitropolsky on the gonality of random graphs. Co-advised with Dan Corey and Dave Jensen.
- Fall 2015 Louis Gaudet. Yale University senior thesis in Hurwitz theory.
- Summer 2016 Derek Boyer, Andre Moura, and Scott Weady on the geometry of tropical line arrangements.
- Summer 2016 Stanislav Atanasov on the Brill–Noether existence conjecture for graphs.
- 2016-17 Johnny Gao in combinatorics and algebraic geometry.
- Summer 2017 Milo Brandt, Michelle Jones, and Catherine Lee on the incidence geometry of tropical lines.
- Summer 2017 Alois Cerbu, Luke Peilen, and Andrew Salmon on the topology of tropical moduli spaces. Co-advised with Steffen Marcus.

## Other students

- Ongoing Andy Fry, Master's and Ph.D. theses, Colorado State University. Co-advised with Renzo Cavalieri.
- Ongoing Jeffrey Yu on Jacobians of finite graphs. High School student, MIT PRIMES-USA program.

## Teaching

- Fall 2017 Instructor, Undergraduate Arithmetic Geometry, MIT.
- Summer 2017 Instructor, Tropical curve counting and moduli, Stockholm University.
- Fall 2016 Instructor, Single and Multivariable Calculus, MIT.
- Summer 2016 Course Assistant, Graduate Summer School on Chip Firing and Tropical Curves, MSRI, Berkeley.
- Spring 2016 Instructor, Calculus II, Yale University.
- Fall 2015 Directed Reading Instructor, Yale University.
- Fall 2014 Instructor, Calculus II, Yale University.
- Spring 2014 Course Assistant: Vector Analysis II, taught by A. Hadari, Yale University.
- Spring 2013 Course Assistant: Multivariable Calculus, taught by M. Havlickova, 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.
- Fall 2015 Active Learning for Calculus.

## 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, 2014, and 2016 I directly supervised undergraduate research students working on projects in combinatorics and algebraic geometry as part of SUMRY.

**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: Pathways to Science Cafe.** 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.

**Middle and High Schools.** I have run a number of discovery-based learning sessions in mathematics for middle and high school students in New Haven and served on career-day panels on several occasions. I have also given talks to middle and high school audiences in India.

## — Service

Freshman advisor, 2017-18, MIT.

Referee for *Advances in Mathematics*, *Annales de l'Institut Fourier*, *Compositio Mathematica*, *Geometry & Topology*, *International Mathematics Research Notices*, *Journal of Differential Geometry*, *Mathematische Annalen*, *Mathematische Zeitschrift*, *Proceedings of the London Mathematical Society*, *Selecta Mathematica*, etc.

Ph.D. thesis committee: Ashwin Deopurkar (Columbia), Keli Santos-Parker (University of Colorado).

Undergraduate thesis committee: Shiyue Li, Harvey Mudd College, 2016-17.

## — References

**Advisor** Sam Payne, Yale University.

Dan Abramovich, Brown University.

Matt Baker, Georgia Institute of Technology.

Renzo Cavalieri, Colorado State University.

Davesh Maulik, Massachusetts Institute of Technology.

Ravi Vakil, Stanford University.

**Teaching** Gigliola Staffilani, Massachusetts Institute of Technology.

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