

# Brandon Shapiro

[bts82@cornell.edu](mailto:bts82@cornell.edu)  
[math.cornell.edu/~bts82](http://math.cornell.edu/~bts82)

## Research Interests

Generalizing concepts of (higher) category theory and universal algebra to structures with arbitrary cell shapes; characterizing capability of presheaf categories to host homotopical models of various higher category theories and type theories; relating computational structure of monad algebras to geometric properties of bar constructions; double categorical approaches to algebraic K-theory.

## Education

- 2017-Present **PhD Student in Mathematics**, *Cornell University*, Advisor: Inna Zakharevich.
- 2019 **Master of Science in Computer Science**, *Cornell University*.  
Supervised by Dexter Kozen.
- 2017 **Bachelor of Arts with Highest Honors in Mathematics**, *Brandeis University*.
- 2017 **Bachelor of Science in Computer Science**, *Brandeis University*.
- 2017 **Bachelor of Arts in Physics**, *Brandeis University*.
- 2016 **Brandeis India Science Scholars Program**, *Indian Institute of Science*.

## Honors and Awards

- 2017 **National Defense Science & Engineering Graduate Fellowship**
- 2017 **Summa Cum Laude**, Brandeis University
- 2017 **Arnold Shapiro Prize in Mathematics**, Brandeis University
- 2017 **Michtom Prize in Computer Science**, Brandeis University
- 2016 **Phi Beta Kappa**, Brandeis University Chapter, Junior Year Inductee
- 2016 **Outstanding Presentation Award**, MAA MathFest 2016
- 2013 **Presidential Merit Scholarship**, Brandeis University
- 2013 **National Merit Scholarship**, Brandeis University

## Papers

- 2020 **Partial Evaluations and the Compositional Structure of the Bar Construction**. *In Preparation*. With Carmen Constantin, Tobias Fritz, and Paolo Perrone. [\[arXiv\]](#)
- 2018 **Densities of Hyperbolic Cusp Invariants**. *Proceedings of the American Mathematical Society*, Volume 146, Number 9, **4073-4089**, 2018. With Colin Adams, Rose Kaplan-Kelly, Michael Moore, Shruthi Sridhar, and Josh Wakefield. [\[arXiv\]](#)
- 2017 **specgen: A Tool for Modeling Statecharts in CSP**. *Nasa Formal Methods* **282**, 2017. With Chris Casinghino.
- 2016 **Nonstandard Neutrino Interactions In Supernovae**. *Physical Review D* **94**, 093007, 2016. With C.J. Stapleford, D.J. Väänänen, J.P. Kneller, and G.C. McLaughlin. [\[arXiv\]](#)

## Conference Talks

- October 2019 **Shape Independent Category Theory**. Category Theory OctoberFest, Baltimore.

- April 2019 **Types as Weak  $\omega$ -Groupoids.** School and Workshop on Univalent Foundations, Birmingham. (Invited, expository)
- August 2018 **Cell Shapes for Higher Structures.** Young Topologists Meeting, Copenhagen. (Expository)
- August 2016 **The Geometry of Knots.** With S. Sridhar. MAA MathFest, Columbus, OH.
- August 2016 **Cusp Density: Dense or Knot?** Unknot III, Columbus, OH.
- August 2014 **Neutrinos and the Unknown** Museum of Natural Sciences, Raleigh, NC.

## ■ Seminar Talks

- September 2020 **Compositional Structure of Partial Evaluations.** MIT Categories Seminar, Online.
- May 2020 **Cubical  $\omega$ -Categories and Cubical  $\Theta$ .** MSRI Cubical Sets Seminar, Online.
- May 2020 **Test Category Structure of Cubes.** MSRI Cubical Sets Seminar, Online.
- May 2020 **Constructing Cubes from Semicubes.** MSRI Cubical Sets Seminar, Online.

## ■ Workshop Participation

- 2020 **Introductory Workshop: Higher Categories and Categorification, MSRI.** TQFT, Trace Methods in K-Theory, Model Independent  $(\infty, 1)$ -Category Theory
- 2019 **Applied Category Theory Adjoint School & Workshop, University of Oxford.** Project on partial evaluations and categorical probability. Mentored by Tobias Fritz, Paolo Perrone.
- 2019 **School & Workshop on Univalent Foundations, University of Birmingham.** Group on formalizing category theory in UniMath.
- 2018 **Homotopy Theory Summer, Berlin Mathematical School.** Equivariant Homotopy Theory & K-Theory,  $\infty$ -Categorical  $A^1$  Homotopy Theory.
- 2018 **Talbot Workshop, Government Camp, OR.** Model Independent  $\infty$ -Category Theory. Mentored by Emily Riehl, Dominic Verity.
- 2016 **SMALL REU, Williams College.** Hyperbolic Knot Theory Group. Advised by Colin Adams.
- 2015 **Internship Project, Draper Laboratories, Formal Methods Group.** Developed and implemented in Haskell a translation model from statecharts into CSPm
- 2014-2015 **Astrophysics Research, Brandeis University.** Analyzed plasma jets from AGN via image processing. Advised by David Roberts.
- 2014 **Computational Astrophysics REU, North Carolina State University.** Analyzed dependence of supernova neutrino oscillations on potential non-standard particle interactions using computer simulation. Advised by James Kneller.

## ■ Teaching

- Summer 2020 **Directed Reading Program, Cornell University.** Mentored an undergraduate in a project on constructive type theory.
- Fall 2019 **Applied Linear Algebra Teaching Assistant, Cornell University, Math 2310.** Ran and designed materials for discussion and review sessions, graded assignments, held office hours.
- Fall 2018 **Geometric Group Theory Teaching Assistant, Cornell University, Math 4560.** Graded proof based assignments, held office hours.

- Fall 2016 **Discrete Math Teaching Assistant**, *Brandeis University*, COSI 29a.  
Graded proof based assignments, held office hours.
- Spring 2015 **Java Programming Teaching Assistant**, *Brandeis University*, COSI 12b.  
Graded programming assignments, gave personalized code reviews, held office hours.
- Spring 2015 **Java Programming Tutor**, *Brandeis University*, COSI 12b.

## ———— Student Seminars

- 2018-Present **Homotopy Group**, *Cornell University*, Organizer, Presenter.
  - 2020 **Logic Seminar**, *Cornell University*, Presenter.
  - 2019 **“What is...?” Seminar**, *Cornell University*, Organizer.
  - 2018  **$\infty$ -Category Theory Reading Group**, *Cornell University*, Presenter.
  - 2018 **Homotopy Type Theory Group**, *Cornell University*, Organizer, Presenter.
- 2017-Present **Olivetti Club**, *Cornell University*, Presenter.
  - 2016-2017 **Floer Homology Group**, *Brandeis University*.
  - 2015 **Haskell and Type Theory Group**, *Brandeis University*.

## ———— Extracurricular

- 2020 **Julia Robinson Math Festival Volunteer**, *Cornell University*.  
Helped elementary school students build and analyze hexaflexagons.
- 2018-Present **Incoming Graduate Student Mentor**, *Cornell University*.
- 2018-Present **Class Representative**, *Cornell University*.  
Represent the concerns and interests of my PhD class to the math department.
  - 2018 **Math Department Spring Concert Organizer**, *Cornell University*.
  - 2018 **Guest Speaker on College Math**, *Walt Whitman High School*.
- 2016-2017 **Math Club Founder and President**, *Brandeis University*.  
Organized meetings and led newly formed math club to student union recognition.
- 2015-2017 **Undergraduate Mathematics Department Representative**, *Brandeis University*.  
Acted as student advisor and undergraduate liaison in math department.  
Organized events and programs for undergraduates in mathematics.