

Sanath Devalapurkar

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Education	Harvard University , Cambridge, MA Ph.D. in Mathematics, expected May 2025 <i>Interests:</i> homotopy theory, and its relationships to p -adic Hodge theory, geometric representation theory, and mathematical physics <i>Advisors:</i> Mike Hopkins and Dennis Gaitsgory Massachusetts Institute of Technology , Cambridge, MA B.S. in Mathematics, Minor in Physics, May 2020 Overall GPA: 4.9/5.0; math GPA: 5.0/5.0	
Publications	<ol style="list-style-type: none">Higher chromatic Thom spectra via unstable homotopy theory (2020). To appear in <i>Algebr. Geom. Topol.</i>Hodge theory for elliptic curves and the Hopf element ν (2019). <i>Bull. Lond. Math. Soc.</i>On the James and Hilton–Milnor splittings, and the metastable EHP sequence (2019). Joint with P. Haine. <i>Doc. Math.</i>Roots of unity in $K(n)$-local rings. <i>Proc. Amer. Math. Soc.</i>	
Preprints (on personal website)	<ol style="list-style-type: none">Derived geometric Satake for $\mathrm{PGL}_2^{\times 3}/\mathrm{PGL}_2^{\mathrm{diag}}$ (2023).ku-theoretic spectral decompositions for spheres and projective spaces. (2023).p-typical curves on p-adic motivic étale cohomology (2023). Joint with S. Mondal.A Long Exact Sequence in Symmetry Breaking: order parameter constraints, defect anomaly-matching, and higher Berry phase (2023). Joint with A. Debray, C. Krulewski, Y. L. Liu, N. Pacheco-Tallaj, and R. Thorngren.Lifting to truncated Brown-Peterson spectra and Hodge-de Rham degeneration in characteristic $p > 0$ (2023).Topological Hochschild homology, truncated Brown-Peterson spectra, and a topological Sen operator (2023).Chromatic aberrations of geometric Satake over the regular locus (2023).Generalized n-series and de Rham complexes (2023). Joint with M. Misterka.Examples of disk algebras (2023). Joint with J. Hahn, T. Lawson, A. Senger, and D. Wilson.Loop groups and intertwinings of positive-energy representations (2021). Chapter 22 of a book edited by A. Amabel, A. Debray, and P. J. Haine.The Ando-Hopkins-Rezk orientation is surjective (2019).The Dieudonné modules and Ekedahl-Oort types of Jacobians of curves in odd characteristic (2017). Joint with J. Halliday.The Lubin-Tate stack and Gross-Hopkins duality (2017).	

Selected awards	<p>Honorable mention, Jane Street Graduate Research Fellowship, 2023</p> <p>NSF Graduate Research Fellowship, 2022 - 2025</p> <p>Fellowship for Students from India, Harvard University, 2021</p> <p>Phi Beta Kappa, 2020</p> <p>Paul and Daisy Soros Fellow, 2020 - 2022</p> <p>James Mills Peirce Fellowship, Harvard University, 2020</p> <p>Finalist at the Intel Science Talent Search; awarded the Seaborg Award and Student Initiative and Research Report badges, 2016</p> <p>First place overall at the European Union Contest for Young Scientists in Italy, 2015</p> <p>First place in mathematics at the Intel International Science and Engineering Fair, 2015</p>
Talks (invited or about my work)	<p><i>Gauss composition and geometric Satake</i> (March 2024), at the arithmetic statistics seminar at Harvard.</p> <p><i>The arithmetic/geometry of quadratic forms, and elliptic curves</i> (Feb 2024), a talk at Harvard/MIT for high school students.</p> <p><i>Equivariant homotopy theory and geometric Langlands duality</i> (Jan 2024), at the algebraic topology seminar at the University of Chicago.</p> <p><i>Equivariant homotopy and Langlands duality</i> (Jan 2024), at the algebraic topology seminar at UCLA.</p> <p><i>Relative Langlands and (chromatic) homotopy theory</i> (Oct 2023), at the Geometry, Symmetry and Physics seminar at Yale.</p> <p><i>Equivariant homotopy theory and geometric Langlands</i> (Oct 2023), at the Algebraic Topology seminar at Princeton.</p> <p><i>Chromatic aberrations of the geometric Satake equivalence</i>, (Apr 2023), at the mathematical physics seminar at the Perimeter Institute for Theoretical Physics.</p> <p><i>Generalized equivariant cohomology and Langlands duality</i>, (Nov 2022 and Feb 2023), series of three lectures at Johns Hopkins University.</p> <p><i>A topological Sen operator</i> (Feb 2023), at the topology seminar at the University of Chicago.</p> <p><i>Chromatic aberrations of the geometric Satake equivalence</i> (March 2022), at the topology seminar at Northwestern University.</p> <p><i>Chromatic Thom spectra and unstable homotopy theory</i> (March 2021), at the topology seminar at the University of Rochester.</p> <p><i>Splitting cobordism spectra</i> (August 2020), at the Moscow-Beijing topology seminar at Tsinghua University.</p>
Teaching	<p>Teaching fellow (primary instructor) for one section of:</p> <ul style="list-style-type: none"> • Math 99 (Integrable Systems) at Harvard (Spring 2024). Website available at https://sanathdevalapurkar.github.io/integrable.html. • Math 1B (Integration, Series and Differential Equations) at Harvard (Fall 2022). <p>Course Assistant (duties include grading and holding office hours) for:</p> <ul style="list-style-type: none"> • Math 223a (Algebraic number theory) at Harvard, taught by Mark Shusterman (Fall 2021).

- **Math 231br (Algebraic topology II)** at Harvard, taught by Mike Hopkins (Spring 2022).

High school research **mentor for PRIMES-USA**:

- Variants of de Rham complexes (Jan - Dec 2022). My student won fourth place in the Regeneron Science Talent Search 2023.
- Conjugation on the dual Steenrod algebra (Jan - Nov 2018).

Helped run the qualifying exam tutorial at Harvard (Fall 2021, Fall 2022): answered students' questions and gave mini-lectures on a variety of topics.

Mentor for Harvard's Directed Reading Program in math, on the following topics:

- p -adic cohomology theories (Fall 2023).
- advanced algebraic topology (Fall 2022).
- cobordism hypothesis and topological quantum field theories (Spring 2022).
- topological K-theory (Fall 2021).
- function fields and elliptic curves (Spring 2021).
- surfaces and Chern classes in differential geometry (Fall 2020).

Grader at MIT (as an undergraduate) for:

- 6.875/18.425 (graduate cryptography and cryptanalysis), September – December 2019.
- 18.A34 (Putnam seminar), September 2017 – December 2017.

**Seminar Talks
(Given in
graduate school)**

Examples in rank 1 (Oct 2023), for the relative Langlands seminar at Harvard.

Uniform p -groups and p -adic Lie algebras (Oct 2023), for a course on p -adic Lie groups (covering for the instructor).

Overview, redux (Oct 2023), for the relative Langlands seminar at Harvard.

Exceptional isomorphisms (Oct 2023), for Trivial Notions at Harvard.

Finite gauge theories and duality (Oct 2023), for the Thursday seminar at Harvard.

The Basel problem and Gauss-Bonnet (Oct 2023), for the graduate student seminar at UChicago.

Homotopy theory as an organizational tool (August 2023), for the Gammage seminar at Harvard.

Identifying two factorization algebras (May 2023), for the Langlands support group at Harvard.

Free Loop Space of a Symplectic Manifold and Symplectic Floer Theory (April 2023), for Juvitop at MIT.

Fundamental local equivalence for tori (March 2023), for the Langlands support group at Harvard.

Chromatic homotopy and geometric Satake (March 2023), for an informal seminar at Harvard.

Filtered prismatization (December 2022), for the Thursday seminar at Harvard.

The BMS approach to p -adic Hodge theory (December 2022), for a reading group at Harvard.

Orientations and the constructible spectrum (November 2022), for Juvitop at MIT.

Witt vectors (November 2022), “office hours” for a course on motivic homotopy theory.

Etale comp-arc-ison (October 2022), for the Thursday seminar at Harvard.

Trivial dualities (October 2022), for Trivial Notions at Harvard.

Anomalies and invertible TQFTs (May 2022), for a seminar on reflection positivity at Harvard.

Mirror symmetry for toric varieties and combinatorics (March 2022), for Trivial Notions at Harvard.

Examples and statement of the quantum Noether theorem (December 2021), two talks for Juvitop on Costello-Gwilliam.

Nonabelian Fourier transform/bi-Whittaker reduction (October 2021), for a seminar on the universal regular centralizer group scheme.

Braided monoidal categories and quantum groups (October 2021), for a seminar on quantum groups.

Ten talks on various topics related to deformation quantization (Summer 2021), for a seminar that I organized; website at <https://sanathdevalapurkar.github.io/quantization.html>.

Poincaré duality in Morava K-theory (April 2021), at a reading seminar on Abouzaid-Blumberg at Harvard-MIT.

Yang-Mills and Hitchin (April 2021), at Beilinson-Drinfeld reading seminar at Harvard.

Families of abelian varieties and stable homology (April 2021), at Juvitop on Feng-Galatiush-Venkatesh’s “The Galois Action on Symplectic K-Theory”.

Periods (April 2021), for Trivial Notions at Harvard.

Perfect prisms and perfectoid rings (April 2021), at the number theory STAGE seminar at MIT on prismatic cohomology.

The p -curvature conjecture (March 2021), at Beilinson-Drinfeld reading seminar at Harvard.

Nilpotent singular support and the Hecke action I and II (March 2021), two talks at a seminar on shtukas at Harvard.

Overview of Beilinson-Drinfeld (November 2020), at Beilinson-Drinfeld reading seminar at Harvard.

Globalization I (November 2020), at the Thursday seminar at Harvard on condensed math.

Hodge theory in positive characteristic (October 2020), for Trivial Notions at Harvard.

Étale fundamental groups (October 2020), at the number theory STAGE seminar at MIT on the Weil conjectures.

Organization

Organized seminars at Harvard on:

- **Relative Langlands**, following Ben-Zvi–Sakellaridis–Venkatesh (Fall 2023). Organized jointly with Ben Gammage. Website available at <https://people.math.harvard.edu/~gammage/relative-fall23.html>.

- **Thursday seminar on unstable homotopy theory and exponent theorems** (Spring 2022). Organized jointly with Mike Hopkins. Website available at <https://sanathdevalapurkar.github.io/thursday-spring-2022.html>.
- **Quantum groups** (Fall 2021).
- **Deformation quantization** (Summer 2021). Website at <https://sanathdevalapurkar.github.io/quantization.html>.
- **Quantization of Hitchin's integrable system/Beilinson-Drinfeld** (Fall 2020 - Spring 2021).

**Work
experience**

Inpher, Lausanne, Switzerland
May - August 2022
Worked on differential privacy

**Service and
miscellany**

Volunteer (every Saturday) at the Cambridge Math Circle (for children between 1st - 8th grade), 2023 – present.

Referee for *Selecta Mathematica*.

Volunteer at Harvard's National Collegiate Research Conference, 2022 and 2023.

Moderator for Vakil's Foundations Of Algebraic Geometry online "course", April 2020 – present.

Reviewer of a textbook on algebraic topology for the MIT press.

Reviewer of a project proposal for the Banff Research institute.

Associate advisor for freshmen, August 2019 – Spring 2020.

The importance of theoretical research (2018). Published in *The Tech*; available at <https://thetech.com/2018/11/01/importance-theoretical-research>.