

# Sanath Devalapurkar

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

<b>Selected awards</b>	<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>
<b>Invited Talks</b>	<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.</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>
<b>Teaching</b>	<p><b>Teaching fellow</b> (primary instructor) for one section of:</p> <ul style="list-style-type: none"> <li>• <b>Math 99 (Integrable Systems)</b> at Harvard (Spring 2024).</li> <li>• <b>Math 1B (Integration, Series and Differential Equations)</b> at Harvard (Fall 2022).</li> </ul> <p><b>Course Assistant</b> (duties include grading and holding office hours) for:</p> <ul style="list-style-type: none"> <li>• <b>Math 223a (Algebraic number theory)</b> at Harvard, taught by Mark Shusterman (Fall 2021).</li> <li>• <b>Math 231br (Algebraic topology II)</b> at Harvard, taught by Mike Hopkins (Spring 2022).</li> </ul> <p>High school research <b>mentor for PRIMES-USA</b>:</p> <ul style="list-style-type: none"> <li>• Variants of de Rham complexes (Jan - Dec 2022). My student won fourth place in the Regeneron Science Talent Search 2023.</li> <li>• Conjugation on the dual Steenrod algebra (Jan - Nov 2018).</li> </ul> <p>Helped run the qualifying exam tutorial at Harvard (Fall 2021, Fall 2022): answered students' questions and gave mini-lectures on a variety of topics.</p> <p>Mentor for Harvard's Directed Reading Program in math, on the following topics:</p>

- $p$ -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-Galatius-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>.