Sanath Devalapurkar

Contact info

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Education

Harvard University, Cambridge, MA
Ph.D. in Mathematics, expected May 2025
Interests: homotopy theory, and its relationships to p-adic Hodge theory, geometric representation theory, and mathematical physics
Advisors: 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

Institutions visited

Northwestern University, Evanston, IL
March - April 2022

Publications

1. Higher chromatic Thom spectra via unstable homotopy theory (2020). To appear in *Algebr. Geom. Topol.*
2. Hodge theory for elliptic curves and the Hopf element ν (2019). *Bull. Lond. Math. Soc.*
3. On the James and Hilton–Milnor splittings, and the metastable EHP sequence (2019). Joint with P. Haine. *Doc. Math.*
4. Roots of unity in $K(n)$-local rings. *Proc. Amer. Math. Soc.*

Preprints (on personal website)

5. Geometric Langlands duality for PGL_2 on the nodal curve (2023).
6. ku-theoretic spectral decompositions for spheres and projective spaces. (2023).
7. p-typical curves on p-adic motivic étale cohomology. Joint with S. Mondal.
8. A Long Exact Sequence in Symmetry Breaking: order parameter constraints, defect anomaly-matching, and higher Berry phase. Joint with A. Debray, C. Krulewski, Y. L. Liu, N. Pacheco-Tallaj, and R. Thorngren.
9. Lifting to truncated Brown-Peterson spectra and Hodge-de Rham degeneration in characteristic $p > 0$ (2023).
10. Topological Hochschild homology, truncated Brown-Peterson spectra, and a topological Sen operator (2023).
11. Chromatic aberrations of geometric Satake over the regular locus (2023).
12. Generalized n-series and de Rham complexes (2023). Joint with M. Misterka.
13. Examples of disk algebras (2023). Joint with J. Hahn, T. Lawson, A. Senger, and D. Wilson.
14. Loop groups and intertwinings of positive-energy representations (2021). Chapter 22 of a book edited by A. Amabel, A. Debray, and P. J. Haine.
15. The Ando-Hopkins-Rezk orientation is surjective (2019).

16. The Dieudonné modules and Ekedahl-Oort types of Jacobians of curves in odd characteristic (2017). Joint with J. Halliday.
17. The Lubin-Tate stack and Gross-Hopkins duality (2017).

Selected awards

Honorable mention, Jane Street Graduate Research Fellowship, 2023
NSF Graduate Research Fellowship, 2022 - 2025
Fellowship for Students from India, Harvard University, 2021
Phi Beta Kappa, 2020
Paul and Daisy Soros Fellow, 2020 - 2022
James Mills Peirce Fellowship, Harvard University, 2020
Finalist at the Intel Science Talent Search; awarded the Seaborg Award and Student Initiative and Research Report badges, 2016
First place overall at the European Union Contest for Young Scientists in Italy, 2015
First place in mathematics at the Intel International Science and Engineering Fair, 2015

Invited Talks

TBD (Oct 2023), at the Geometry, Symmetry and Physics seminar at Yale.

TBD (Oct 2023), at the Algebraic Topology seminar at Princeton.

Chromatic aberrations of the geometric Satake equivalence, (Apr 2023), at the mathematical physics seminar at the Perimeter Insitute.

Generalized equivariant cohomology and Langlands duality, (Nov 2022 and Feb 2023), series of three lectures at Johns Hopkins University.

A topological Sen operator (Feb 2023), at the topology seminar at the University of Chicago.

Chromatic aberrations of the geometric Satake equivalence (March 2022), at the topology seminar at Northwestern University.

Chromatic Thom spectra and unstable homotopy theory (March 2021), at the topology seminar at the University of Rochester.

Splitting cobordism spectra (August 2020), at the Moscow-Beijing topology seminar at Tsinghua University.

Teaching

Teaching fellow (primary instructor) for one section of:

- **Math 99 (Integrable Systems)** at Harvard (Spring 2024).
- **Math 1B (Integration, Series and Differential Equations)** at Harvard (Fall 2022).

Course Assistant (duties include grading and holding office hours) for:

- **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:

- 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)

Overview and *Examples in rank 1* (October 2023), two talks at the relative Langlands seminar at Harvard.

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), at 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), at 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), at 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), at 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).

Service and miscellany

Volunteer at Cambridge Math Circle (for children between 2nd - 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`.