

Sunghyuk Park

Curriculum Vitae

Harvard University
Department of Mathematics
Cambridge, MA 02138
☎ +1 626-200-9234
✉ sunghyukpark@math.harvard.edu
🌐 categorical.center

Research Interests

Geometry and topology inspired by quantum physics (physical mathematics);
TQFTs, topological string theory, complex Chern-Simons theory, categorification

Employment

Postdoctoral Fellow, *Harvard University*, 2023–2026.

Benjamin Peirce Fellow in the Department of Mathematics & Simons Collaboration Postdoctoral Fellow at CMSA

Postdoctoral Fellow, *University of Texas at Austin*, 2022–2023.

Simons Collaboration Postdoctoral Fellow in the Department of Mathematics

Education

PhD in Mathematics, *California Institute of Technology*, 2017–2022.

Thesis: “3-manifolds, q -series, and topological strings”

Adviser: Prof. Sergei Gukov.

BS in Mathematics, *Korea Advanced Institute of Science and Technology*, 2014–2017.

Summa Cum Laude, Valedictorian

High School Diploma, *Korea Science Academy of KAIST*, 2011–2014.

Publications

Papers

Skeins, q -series, and modularity.

arXiv:2601.18042

Appendix to: **Generalized Global Symmetries of T[M] Theories: Part II**, by *Sergei Gukov, Po-Shen Hsin, and Du Pei*.

arXiv:2511.13696

Skein traces from curve counting, with *Tobias Ekholm, Pietro Longhi, and Vivek Shende*.

arXiv:2510.19041

Compatibility of quantum trace and UV-IR maps, with *Samuel Panitch*.

arXiv:2509.09100

Quivers and BPS states in 3d and 4d,

with *Piotr Kucharski, Pietro Longhi, Dmitry Noshchenko, and Piotr Sułkowski*.

arXiv:2508.09729

Knot lattice homology and q-series invariants for plumbed knot complements,

with Ross Akhmechet and Peter K. Johnson

Quantum Topology (2025), published online first

arXiv:2403.14461

3d quantum trace map, with Samuel Panitch

Algebraic & Geometric Topology (to appear)

arXiv:2403.12850

Branches, quivers, and ideals for knot complements,

with Tobias Ekholm, Angus Gruen, Sergei Gukov, Piotr Kucharski, Marko Stošić, and Piotr Sułkowski.

Journal of Geometry and Physics 177 (2022), 104520

arXiv:2110.13768

Inverted state sums, inverted Habiro series, and indefinite theta functions.

arXiv:2106.03942

Cobordism invariants from BPS q-series, with Sergei Gukov and Pavel Putrov.

Annales Henri Poincaré 22 (2021), 4173-4203.

arXiv:2009.11874

\widehat{Z} at large N: from curve counts to quantum modularity,

with Tobias Ekholm, Angus Gruen, Sergei Gukov, Piotr Kucharski, and Piotr Sułkowski.

Communications in Mathematical Physics 396 (2022), 143–186

arXiv:2005.13349

Rozansky-Witten geometry of Coulomb branches and logarithmic knot invariants,

with Sergei Gukov, Po-Shen Hsin, Hiraku Nakajima, Du Pei, and Nikita Sopenko.

Journal of Geometry and Physics 168 (2021), 104311.

arXiv:2005.05347

Large color R-matrix for knot complements and strange identities.

Journal of Knot Theory and Its Ramifications 29 (2020), no. 14, 2050097.

arXiv:2004.02087

3d-3d correspondence for mapping tori, with Sungbong Chun, Sergei Gukov, and Nikita Sopenko.

Journal of High Energy Physics 09 (2020), 152.

arXiv:1911.08456

Higher rank \widehat{Z} and F_K .

Symmetry, Integrability and Geometry: Methods and Applications (SIGMA) 16 (2020), 044.

arXiv:1909.13002

Prague clocks, with Chan Bae, John Conway, and Lukas Kohlhase.

The Mathematical Intelligencer 38 (2016), 37–39.

[Book Chapters](#)

New quantum invariants from braiding Verma modules, with Sergei Gukov.

a chapter in New Structures in Low-Dimensional Topology, Bolyai Society Lecture Notes (2026)

Honors

Junior Fellowship for the program “Knots, Strings, Symplectic Geometry and Dualities”, Institut Mittag-Leffler, 2020.

Scott Russell Johnson Prize for Excellence in Graduate Studies, Caltech, 2020.

Scott Russell Johnson Prize for Excellence in First-Year Graduate Studies, Caltech, 2018.

Kwanjeong Educational Foundation Scholarship, 2017-2022.

Valedictorian, KAIST Class of 2017; Recipient of the Minister’s Award, presented by the Minister of Science and ICT, South Korea, 2017

KAIST Presidential Fellowship, KAIST, 2016-2017.

First Place in National Undergraduate Mathematics Competition, Korean Mathematical Society, 2015.

Korean Presidential Science Scholarship for Overseas Study, 2014. (declined)

Talent Medal of Korea (Presidential Award), presented by the President of South Korea, 2013.

Professional Service

Referee for:

Algebra & Number Theory*, Communications in Mathematical Physics (3 times),
Crelle’s Journal (2 times), Experimental Mathematics, Journal of High Energy Physics,
Journal of Knot Theory and Its Ramifications, Journal of Pure and Applied Algebra*, Journal of Topology,
Letters in Mathematical Physics, Quantum Topology,
Symmetry, Integrability and Geometry: Methods and Applications (4 times). (*= quick opinion)

Reviewer for:

Mathematical Reviews, zbMATH Open (6 times).

Teaching and Mentoring

Mentoring

Supervised Undergraduate Students at Harvard

- Madeleine de Belloy, June-August 2025, Harvard Math Summer REU.
- Halyna Bowley, June-August 2025, Harvard Math Summer REU.

Supervised Undergraduate Students at Caltech

- Alberto Ricardo Cavallar Oriol, February-July 2022,
visiting student from Polytechnic University of Catalonia, Undergraduate Thesis.

Teaching

Instructor at Harvard, 2023-2026.

- Math 132: **Differential Topology**, Spring 2026.
- Math 112: **Introductory Real Analysis**, Spring 2025.
- Math 264R: **Quantum Topology** (graduate topics course), Spring 2024.

Instructor at UT Austin, 2022-2023.

- M408S: **Integral Calculus for Science** (calculus for non-math majors), Fall 2022.

Teaching Assistant at Caltech, 2017-2022.

Recitations, grading homework and exams, office hours, typing up solutions

- Math 11: **Mathematical Writing**, Spring 2022. Instructor: Tom Graber
- Math 1a: **Calculus of One Variable**, Fall 2021, head TA, double. Instructor: Nets Katz
- Math 1a: **Calculus of One Variable**, Fall 2020, double. Instructor: Nets Katz
- Math 5c: **Introduction to Abstract Algebra**, Spring 2020. Instructor: Elena Mantovan
- Math 121a: **Combinatorial Analysis**, Winter 2020. Instructor: Mykhaylo Tyomkyn
- Math 121a: **Combinatorial Analysis**, Fall 2018. Instructor: Ben Krause
- Math 3: **Introduction to Probability and Statistics**, Winter 2018. Instructor: Kim Border

Teaching Assistant at PCMI Summer Session 2019, PCMI, July 2019.

Problem sessions for the lecture series by Pavel Putrov

Teaching Assistant at KAIST, 2015-2017.

Office hours, tutoring

- Calculus I
- General physics I

Teaching Assistant at Korean Mathematical Olympiad Winter School, KAIST, January 2016.

Problem sessions, grading exams

Organization

Seminars and Colloquia

CMSA Colloquium,

with Houcine Ben Dali, Tomer Ezra, and Francesco Mori, Fall 2025-.

<https://cmsa.fas.harvard.edu/events-archive/category/colloquia-seminar/colloquia/>

Global Categorical Symmetries Postdoc and Student Colloquium,

with Konstantinos Roumpedakis, Fall 2024-Spring 2025.

<https://sites.google.com/perimeterinstitute.ca/gcs-colloquium/home>

Quantum Field Theory and Physical Mathematics Seminar,

with Ahsan Khan and Robert Moscrop, Harvard CMSA, Fall 2024-Spring 2025.

<https://cmsa.fas.harvard.edu/events-archive/category/qft/>

Question and Answer Seminar,

with Dan Freed, Harvard CMSA, Fall 2023-Spring 2024.

<https://cmsa.fas.harvard.edu/events-archive/category/cmsaqa/>

Factorization Algebras in Quantum Field Theory Learning Seminar,

with Tamir Hemo, Caltech, Fall 2019.

https://www.its.caltech.edu/~themo/factorization_seminar/factorization.html

Invited Talks

Conferences / Workshops

Physical Mathematics 2026 in Korea, Seoul National University, June 2026.

New Structures in Low-Dimensional Topology Workshop 2026, AIM, June 2026.

- three-part lecture series

AMS Special Session: Topology, Gauge Theory, and Special Geometric Structures, Boston College, March 2026.

AMS Special Session: Sheaf-Theoretic and Floer-Theoretic Approaches to Contact and Symplectic Topology, Boston College, March 2026.

New perspectives on skein modules, CIRM, July 2025.

AMS Special Session: Knot Theory and Quantum Topology, Cal Poly, May 2025.

Knots, Quivers and Beyond, IIT Bombay, February 2025.

Recent Developments in TQFT, BIMSA, September 2024.

2024 Richmond Geometry Meeting, VCU, August 2024.

New Structures in Low-Dimensional Topology 2024 Summer School, Renyi Institute, July 2024.

- two-part lecture series

BPS Dynamics and Quantum Mathematics, Galileo Galilei Institute, June 2024.

Summary workshop: Knots, homologies and physics, University of Warsaw, May 2024.

Learning workshop: Knots, homologies and physics, University of Warsaw, March 2024.

Meeting on Plumblings and Spectra, Caltech, March 2024.

AMS Special Session: Mock Modular Forms, Physics, and Applications, Moscone Center, January 2024.

CMI Workshop: Symplectic Geometry, Low Dimensional Topology, and Quantum Fields, University of Oxford, September 2023.

Merging Categorification, Gauge Theory, and Physics, Hotel Belalp, September 2023.

Learning Workshop on BPS States and 3-Manifolds, ICTP, February 2023.

Field Theories and Vertex Algebras, Lake Arrowhead Resort and Spa, October 2022.

String Math 2022, University of Warsaw, July 2022.

- plenary talk

AMS Special Session: q -series, Number Theory and Quantum Topology, May 2022.

Research Seminars

Quantum Topology and Field Theory Seminar, **Yale University**, February 2026.

Symplectic Geometry Seminar, **Stanford University**, January 2026.

Infinite Dimensional Algebra Seminar, **MIT**, November 2025.

Topology Seminar, **UCSB**, May 2025.

Quantum Topology and Field Theory Seminar, **Yale University**, November 2024.

Geometry and Quantum Theory Seminar, **Harvard University**, October 2024.

Topology Seminar, **Michigan State University**, October 2024.

HCMC Colloquium, **KIAS**, August 2024.

Geometry, Algebra and Physics Seminar, **KIAS**, April 2024.
Geometry and Topology Seminar, **MIT**, October 2023.
Gauge Theory and Topology Seminar, **Harvard University**, October 2023.
Geometry and Physics Seminar, **Boston University**, October 2023.
Geometry Seminar, **UT Austin**, April 2022.
String-Math Seminar, **UC Berkeley**, March 2022.
Quantum Topology Seminar, **Indiana University Bloomington**, January 2022.
Geometry Seminar, **University of Virginia**, January 2022.
Algebra Seminar, **University of Southern California**, October 2021.
Strings and QFTs for Eurasian Time Zone, **Fudan University**, December 2020.
Geometry and Physics Seminar, **Harvard CMSA**, June 2020.
Moscow-Beijing Topology Seminar, June 2020.
Topology Seminar, **Stanford University**, January 2020.

Expository Lectures

Lectures on Theoretical Physics for Latin American Students, ICTP Physics Without Frontiers, November 2023.