Junehyuk Jung

✉ junehyuk_jung@brown.edu   •   ⌂ sites.google.com/brown.edu/junehyuk/

Positions

Brown University, Department of Mathematics   **Providence, RI**
Associate Professor of Mathematics   *7/2022–*

Google DeepMind   **Mountain View, CA**
Visiting Researcher   *4/2024–*

Brown University, Department of Mathematics   **Providence, RI**
Assistant Professor of Mathematics   *7/2020–6/2022*

Texas A&M University, Department of Mathematics   **College Station, TX**
Assistant Professor   *8/2017–6/2020*

KAIST, Department of Mathematical Science   **Daejeon, South Korea**
Researcher   *6/2013–7/2016*

Visiting Positions

University of California Berkeley, Department of Mathematics   **Berkeley, CA**
Visitor   *7/2023–7/2024*

Rice University, Department of Mathematics   **Houston, TX**
Adjunct Assistant Professor   *7/2019–3/2020*

Yale University, Department of Mathematics   **New Haven, CT**
Visitor   *4/2017–6/2017*

University of California Berkeley, Department of Mathematics   **Berkeley, CA**
Visitor   *2/2017–3/2017*

Northwestern University, Mathematics Department   **Evanston, IL**
Visitor   *10/2016–11/2016*

Institute for Advanced Study, School of Mathematics   **Princeton, NJ**
Member   *9/2014–12/2015*

Northwestern University, Mathematics Department   **Evanston, IL**
Visiting Postdoctoral Fellow   *9/2013–12/2013*

Education

Princeton University   **Princeton, NJ**
Doctor of Philosophy   *9/2008–6/2013*
Mathematics
Advisor: Peter C. Sarnak

University of Chicago   **Chicago, IL**
Master of Science   *9/2006–8/2008*
Mathematics

University of Chicago   **Chicago, IL**
Bachelor of Arts   *9/2005–8/2008*
Mathematics with Honors

Honors and Awards

Simons Fellows in Mathematics
Awarded *7/2023–6/2024*

National Science Foundation grant
Awarded, DMS-1900993 *7/2019–6/2023*

Sloan Research Fellowship
Awarded, $ 70,000 *7/2019–8/2023*

Posco TJ Park Science Fellowship
Awarded, $ 35,000 per year *3/2014–2/2016*

Samsung Scholarship for Graduate Studies
Awarded, $ 50,000 per year *9/2008–6/2013*

Paul R. Cohen Memorial Prize
Awarded *6/2008*

Kwanjeong Scholarship for College Students
Awarded, $ 50,000 per year *9/2005–8/2008*

Korea Science and Engineering Foundation Scholarship for Undergraduate Studies
Gratefully declined in order to observe institutional regulation *2005*

William Lowell Putnam Mathematics Competition
One of three representatives of University of Chicago *2005–2007*
Honorable Mention, Team Rank 5, and Top 24 Individuals in 2005, 2006, and 2007

International Mathematical Olympiad
Gold Medal *7/2003*

Publications

Published/Accepted

[**19**]: "2-nodal domain theorems for higher dimensional circle bundles"
(with Steve Zelditch)
J. Spectr. Theory 14 (2024), no. 4, pp. 1451–1474.

[**18**]: "Intersecting geodesics on the modular surface"
(with Naser T. Sardari)
Algebra Number Theory 17 (2023), no. 7, 1325–1357.

[**17**]: "Non-vanishing of symmetric cube L-functions"
(with Jeff Hoffstein and Min Lee)
J. Lond. Math. Soc. (2) 107 (2023), no. 1, 153–188.

[**16**]: "Embedding closed totally geodesic surfaces in Bianchi orbifolds"
(with Alan Reid)
arXiv:2003.05427 [math.NT], to appear *Math. Res. Lett.*

[**15**]: "Topology of the nodal set of random equivariant spherical harmonics on $\mathbb{S}^3$"
(with Steve Zelditch)
Int. Math. Res. Not. IMRN(2021), no. 11, 8521–8549.

[**14**]: "Asymptotic trace formula for the Hecke operators"
(with Simon Marshall and Naser T. Sardari)
Math. Ann. 378 (2020), no. 1-2, 513–557.

[**13**]: "Boundedness of the number of nodal domains for eigenfunctions of generic Kaluza–Klein 3-folds"
(with Steve Zelditch)
Ann. Inst. Fourier (Grenoble) 70 (2020), no. 3, 971–1027.

[**12**]: " Bounding the number of nodal domains of eigenfunctions without singular points on the square"
Israel J. Math. 238 (2020), no. 1, 1–11.

[**11**]: "On the growth of the number of totally geodesic surfaces in some hyperbolic 3-manifolds"
J. Number Theory 202 (2019), 160–175.

[**10**]: "Sign Changes of the Eisenstein Series on the Critical Line"
(with Matthew Young)
Int. Math. Res. Not. IMRN(2019), no. 3, 641–672.

[**9**]: "Discrete behavior in information-constrained tracking problems and portfolio choice"
(with Jeong-ho Kim, Filip Matejka, and Christopher A. Sims)
Rev. Econ. Stud. 86 (2019), no. 6, 2643–2667.

[**8**]: "On tiling the integers with 4-sets of the same gap sequence"
(with Ilkyoo Choi and Minki Kim)
Discrete Math. 341 (2018), no. 4, 957–964.

[**7**]: "Quantum unique ergodicity and the number of nodal domains of eigenfunctions"
(with Seung uk Jang)
J. Amer. Math. Soc. 31 (2018), no. 2, 303–318.

[**6**]: "On sparsity of positive-definite automorphic forms within a family"
(Appendix A by Junehyuk Jung and Sug Woo Shin)
J. Anal. Math. 129 (2016), 105–138.

[**5**]: "Quantitative quantum ergodicity and the nodal domains of Maass-Hecke cusp forms "
Comm. Math. Phys. 348 (2016), no. 2, 603–653.

[**4**]: "Number of nodal domains and singular points of eigenfunctions of negatively curved surfaces with an isometric involution"
(with Steve Zelditch)
J. Differential Geom. 102 (2016), no. 1, 37–66.

[**3**]: "Number of nodal domains of eigenfunctions on non-positively curved surfaces with concave boundary"
(with Steve Zelditch)
Math. Ann. 364 (2016), no. 3-4, 813–840.

[**2**]: "Sharp bounds for the intersection of nodal lines with certain curves "
J. Eur. Math. Soc. (JEMS) 16 (2014), no. 2, 273–288.

[**1**]: "Pretentiously detecting power cancellation"
(with Robert J. Lemke Oliver)
Math. Proc. Cambridge Philos. Soc. 154 (2013), no. 3, 481–498.

Selected Preprints

[**3**]: "Gold-medalist Performance in Solving Olympiad Geometry with AlphaGeometry2"
(with Yuri Chervonyi, Trieu H. Trinh, Miroslav Olšák, Xiaomeng Yang, Hoang Nguyen, Marcelo Menegali, Vikas Verma, Quoc V. Le, and Thang Luong)
arXiv:2502.03544 [cs.AI]

[**2**]: "Gemini 1.5: Unlocking multimodal understanding across millions of tokens of context"
(one of the 1136 authors from Gemini Team, Google)
arXiv:2403.05530 [cs.CL]

[**1**]: "Linnik problem for Maass–Hecke cusp forms and effective multiplicity one theorem"
(with Min Lee)
arXiv:2502.16046 [math.NT]

Talks and lecture series

Public Lectures

03/18/2025: "ICERM Public Lecture: AlphaGeometry: a step toward automated math reasoning"
ICERM, Providence, RI, US

02/08/2020: "Aggieland Saturday"
Texas A&M University, College Station, TX, US

08/17/2018: "Summer Educational Enrichment in Math (SEE-Math)"
Texas A&M University, College Station, TX, US

Panelist

12/14/2024: 4th MATH-AI Workshop at NeurIPS'24
Vancouver Convention Centre, Vancouver, BC, Canada

Invited Talks

01/22/2024: "Zelditch's trace formula and effective Bowen's theorem"
Analytic Number Theory Seminar
Stanford University, Palo Alto, CA, USA

12/19/2023: "Zelditch's trace formula and effective Bowen's theorem"
Conference: Hyperbolic Geometry of Numbers
KIAS, Seoul, South Korea

11/07/2023: "Zelditch's trace formula and effective Bowen's theorem"
Arizona Algebra and Number Theory Seminar
University of Arizona, Tucson, AZ, USA

10/14/2023: "Zelditch's trace formula and effective Bowen's theorem"
Spectral Theory and Applications
Texas A&M University, College Station, TX, USA

09/25/2023: "On the sparsity of positive-definite automorphic forms"
Arithmetic Geometry and Number Theory RTG Seminar
University of California, Berkeley, Berkeley, CA, USA

09/25/2023: "Background on automorphic forms, L-functions, and equidistribution. "
Arithmetic Geometry and Number Theory RTG Seminar: Pre-talk
University of California, Berkeley, Berkeley, CA, USA

09/18/2023: "Nodal domains of equivariant eigenfunctions on Kaluza-Klein 3-folds"
Analysis & PDE Seminar
University of California, Berkeley, Berkeley, CA, USA

05/23/2023: "Chaos and the geometry of the nodal set of eigenfunctions of the Laplacian"
PDT Research Colloquium
PDT Partners, New York, NY, USA

05/19/2023: "The arithmetic of totally geodesic surfaces on Bianchi orbifolds"
Dynamics, Rigidity and Arithmetic in Hyperbolic Geometry
ICERM, Providence, RI, USA

03/23/2023: "Equidistribution problems of closed geodesics on hyperbolic surfaces"
QVNTS
Concordia University, Montreal, Quebec, Canada

02/28/2023: "The arithmetic of totally geodesic surfaces on Bianchi orbifolds"
Algebra and Number Theory seminar
Dartmouth College, Hanover, NH, USA

10/27/2022: "Ergodicity and the number of nodal domains of eigenfunctions of the Laplacian"
Brandeis-Harvard-MIT-Northeastern Joint Mathematics Colloquium
Brandeis University, Waltham, MA, USA

01/27/2020: "Ergodicity and the number of nodal domains of eigenfunctions of the Laplacian"
Special Colloquium
Brown University, Providence, RI, USA

12/13/2019: "Ergodicity and the number of nodal domains of eigenfunctions of the Laplacian"
Colloquium
Rice University, Houston, TX, USA

10/11/2019: "Nodal domains of equivariant eigenfunctions on Kaluza-Klein 3-folds"
Analysis and Mathematical Physics Seminar Series
Institute for Advanced Study, Princeton, NJ, USA

10/02/2019: "Classification of embedded closed totally geodesic surfaces in Bianchi 3-folds"
Topology Seminar
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

09/25/2019: "Topology of the nodal set of spherical harmonics on S^3"
Dynamics and Number Theory Seminar
Seoul National University, Seoul, South Korea

05/21/2019: "On the sparsity of positive-definite automorphic forms"
Heilbronn Number Theory Seminar
University of Bristol, Bristol, UK

02/19/2019: "Nodal geometry of Maass–Hecke eigenforms on compact arithmetic hyperbolic triangles"
Algebraic Geometry and Number Theory Seminar
Rice University, Houston, TX, USA

01/15/2019: "Large discrepancy in the vertical Sato-Tate theorem"
Analytic Number Theory Seminar
Stanford University, Stanford, CA, USA

01/07/2019: "Distribution of Hecke eigenvalues: large discrepancy"
Korea University Algebra Seminar
Korea University, Seoul, South Korea

12/28/2018: "Counting immersed totally geodesic surfaces via arithmetic means"
Contemporary Number Theory Workshop
KAIST, Daejeon, South Korea

12/27/2018: "Distribution of Hecke eigenvalues: large discrepancy"
Contemporary Number Theory Workshop
KAIST, Daejeon, South Korea

12/21/2018: "Nodal counting of eigenfunctions of Laplace–Beltrami operator on a principal S^1-bundle with Kaluza–Klein metrics"
CMC Seminar
KIAS, Seoul, South Korea

12/14/2018: "Ergodicity and nodal counting of eigenfunctions on 3-manifolds"
Geometry, Topology & Dynamics Seminar
Seoul National University, Seoul, South Korea

07/23/2018: "Ergodicity and the number of nodal domains of Laplacian eigenfunctions"
Analytic Number Theory and Quantum Chaos Workshop
Queen Mary University of London, London, UK

07/17/2018: "Boundedness of the number of nodal domains of eigenfunctions"
18w5002 Around Quantum Chaos
BIRS, Banff, Canada

07/04/2018: "Quantum Unique Ergodicity and the number of nodal domains of automorphic forms"
Analytic Number Theory Seminar
EPFL, Laussane, Switzerland

04/11/2018: "Quantum Unique Ergodicity and the number of nodal domains of automorphic forms"
Number Theory Seminar
University of Wisconsin - Madison, Madison, WI, USA

01/24/2017: "On nodal domains of eigenfunctions in chaotic quantum systems"
Colloquium
Texas A&M University, College Station, TX, USA

01/09/2017: "Quantitative Quantum Ergodicity on the modular surface and its applications"
Number Theory Seminar
Stanford University, Stanford, CA, USA

11/14/2016: "Eigenfunctions on arithmetic hyperbolic surfaces"
Analysis Seminar
Northwestern University, Evanston, IL, USA

07/12/2016: "On nodal domains of eigenfunctions in chaotic quantum system"
Second French-Korean Conference in Mathematics
Université de Bordeaux, Bordeaux, France

03/16/2016: "Nodal domains of eigenfunctions on chaotic billiards"
SNU Geometry and Topology Seminar
Seoul National University, Seoul, South Korea

02/15/2016: "On arithmetic quantum chaos: introduction and recent progress"
The 5th Number Theory Festival
Kyungnam University, Changwon, South Korea

08/27/2015: "Quantum Unique Ergodicity and the number of nodal domains of eigenfunctions"
East Asia Number Theory Conference
Elysian Gangchon Resort, Chuncheon, South Korea

06/21/2015: "Quantum Ergodicity and the number of nodal domains of eigenfunctions"
ASARC Number Theory Workshop
Tongyeong Marina Resort, Tongyeong, South Korea

06/04/2015: "Quantum Ergodicity and the number of nodal domains of eigenfunctions"
Montreal Analysis Seminar
McGill University, Montréal, QC, Canada

04/07/2015: "Quantum ergodicity and the number of nodal domains of eigenfunctions"
TAMU number theory seminar
Texas A&M University, College Station, TX, USA

02/21/2015: "Quantum ergodicity and the number of nodal domains of eigenfunctions"
Special day on Complex Geometry and Analysis on real analytic Riemannian manifolds
Northwestern University, Evanston, IL, USA

08/05/2014: "An upper bound for intersection of nodal lines with a fixed horocycle"
Pan Asia Number Theory 2014
Postech, Pohang, South Korea

03/03/2014: "Nodal Domains and Eigenfunctions of Negatively Curved Surfaces"
Quantum Monday
Institute for Basic Science, Pohang, South Korea

02/28/2014: "Nodal Domains and Eigenfunctions of Negatively Curved Surfaces"
Lecture Series on Geometry and Analysis
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

02/22/2014: "Lindelof Hypothesis on average for triple product L-functions and its application"
Number Theory Festival
KAIST, Daejeon, South Korea

01/22/2014: "On the sparsity of positive-definite automorphic forms within a family"

East Asia Number Theory Conference
Nishijin Plaza, Fukuoka, Japan

01/17/2014: "Zero density estimates for families of automorphic L-functions of GL_1 and GL_2 over $\mathbb{Q}$"
Applications of homotopy method in number theory
Yonsei University, Seoul, South Korea

12/16/2013: "Nodal Domains and Eigenfunctions of Negatively Curved Surfaces"
The 17th Midrasha Mathematicae
Israel Institute for Advanced Studies (IIAS), Jerusalem, Israel

11/25/2013: "Nodal Domains and Eigenfunctions of Negatively Curved Surfaces"
Algebra Seminar
Brown University, Providence, RI, USA

10/29/2012: "An upper bound for intersection of nodal lines with a fixed horocycle"
NU Number Theory Seminar
Northwestern University, Evanston, IL, USA

07/26/2012: "On the sparsity of positive-definite automorphic forms within a family"
Number Theory Seminar
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

Contributed Talks

10/20/2022: "Non-vanishing of symmetric cube automorphic L-functions"
2022 Global KMS International Conference
Online

05/02/2022: "The arithmetic of totally geodesic surfaces on Bianchi orbifolds"
Brown Algebra Seminar
Brown University

08/12/2021: "Boundedness of the number of nodal domains of equivariant eigenfunctions"
International Workshop on Operator Theory and its Applications 2021 Special Session 5
Online

02/01/2021: "Intersecting geodesics on the modular surface"
Brown Algebra Seminar
Brown University

12/08/2020: "Intersections of geodesics on the modular surface"
2020 CMS Winter Meeting Scientific Session on Equidistribution on Arithmetic Manifolds
Online

09/21/2020: "On the sparsity of positive-definite automorphic forms"
Brown Algebra/Number Theory Seminar
Brown University

09/03/2020: "Geometry and analytic number theory"
Meet the faculty!
Brown University

01/16/2020: "On the sparsity of positive-definite automorphic forms"
AMS Special Session on Analytic Theory of Automorphic Forms and L-Functions, I
Colorado Convention Center, Denver, CO, USA

09/15/2019: "Bounding the dimension of a joint eigenspace of Laplacian and finitely many Hecke operators"
AMS Sectional Meeting-Automorphic Forms and L-Functions, III
University of Wisconsin-Madison

05/03/2018: "Boundedness of the number of nodal domains of eigenfunctions"
Mathematical Physics and Harmonic Analysis Seminar
Texas A&M University

10/18/2017: "Counting immersed totally geodesic surfaces via arithmetic means"

Number Theory Seminar
Texas A&M University

01/30/2017: "Quantum Unique Ergodicity and the number of nodal domains of eigenfunctions"
Group actions and Dynamics seminar
Yale University

01/08/2016: "Quantum unique ergodicity and the number of nodal domains of eigenfunctions"
AMS Special Session on Global Harmonic Analysis
Washington State Convention Center, Seattle, WA, USA

03/16/2015: "Quantum ergodicity and the number of nodal domains of eigenfunctions"
IAS Spectral Geometry Seminar
Institute for Advanced Study, Princeton, NJ, USA

03/03/2015: "Quantum ergodicity and the number of nodal domains of eigenfunctions"
Berkeley Harmonic Analysis and Differential Equation Student Seminar
University of California, Berkeley, Berkeley, CA, USA

09/25/2014: "Counting the nodal domains of the Laplacian eigenfunctions on surfaces"
Short talks by postdoctoral members
Institute for Advanced Study, Princeton, NJ, USA

05/26/2014: "Automorphic L-functions and conjectures"
Colloqium for undergraduate students
KAIST, Daejeon, South Korea

10/22/2013: "Number of Nodal Domains of Eigenfunctions of Negatively Curved Surfaces with an Isometric Involution"
ASARC Seminar
KAIST, Daejeon, South Korea

06/28/2013: "Restricted L^p estimates and the zero set of Maass forms"
ASARC Seminar
KAIST, Daejeon, South Korea

Lecture Series

03/2021: 'Equidistribution problems of closed geodesics on hyperbolic surfaces (part 1&2)"
Geometry, Topology & Dynamics Seminar
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

03/2019: "Counting primitive totally geodesic submanifolds 1&2"
Number Theory Lecture Series
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

06/2016: "Recent theory on arithmetic quantum chaos"
Number Theory Lecture Series
Korea Institute for Advanced Study (KIAS), Seoul, South Korea

05/2015: "Introduction to quantum ergodicity and the number of nodal domains of eigenfunctions"
Colloquium
Korea University, Seoul, South Korea

07/2014: "Spectral theory of hyperbolic surfaces: arithmetic surfaces and Selberg's eigenvalue conjecture"
PMI Intensitve Lecture series in Number Theory
Postech, Pohang, South Korea

05/2014–06/2014: "Spectral theory of hyperbolic surfaces: arithmetic surfaces and Selberg's eigenvalue conjecture"
Special Lecture Series
Yonsei University, Seoul, South Korea