Jonathan Winghong Luk

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Education

Ph.D. in Mathematics, Princeton University, June 2012.

Advisor: Igor Rodnianski

Thesis Title: Linear and Nonlinear Wave Equations on Black Hole Spacetimes

B.A. in Mathematics and B.S. in Physics, *Summa Cum Laude*, UC San Diego, 2007.

Positions

Professor, Stanford University, Sept 2023–.

Associate Professor, Stanford University, Jan 2019–Aug 2023.

Assistant Professor, Stanford University, Sept 2016–Dec 2018.

Lecturer, Cambridge University, Oct 2014–Aug 2016.

C.L.E. Moore Instructor, MIT, Sept 2013–Sept 2014.

NSF Postdoctoral Fellow, University of Pennsylvania, Sept 2012–Aug 2013.

Visiting Position

Visiting Research Collaborator, Princeton University, Oct 2012–Aug 2013.

Research Interests

Nonlinear Partial Differential Equations, General Relativity, Mathematical Physics

Publications and Preprints

J. Luk, S.-J. Oh and C. Warnick. Stability of the Minkowski spacetime in Newman-Unti gauge, arXiv:2606.31090, preprint.

J. Luk and J. Sbierski. The formation of a weak null singularity in the interior of generic rotating black holes, arXiv:2604.04877, preprint.

J. Luk, S.-J. Oh and D. Yu. Late-time tail for a scalar quasilinear wave equation satisfying the weak null condition, arXiv:2510.22122, preprint.

C. Huneau and J. Luk. High-frequency backreaction for the Einstein equations under U(1) symmetry: from Einstein–dust to Einstein–Vlasov, arXiv:2506.21779, preprint.

S. Chaturvedi and J. Luk. Linear and nonlinear phase mixing for the gravitational Vlasov-Poisson system under an external Kepler potential, arXiv:2409.14626, preprint.

C. Huneau and J. Luk. High-frequency solutions to the Einstein equations, *Classical and Quantum Gravity*, 41:143002, 2024.

J. Luk and S.-J. Oh. Late time tail of waves on dynamic asymptotically flat spacetimes of odd space dimensions, preprint.

C. Huneau and J. Luk. Burnett's conjecture in generalized wave coordinates, arXiv:2403.03470, preprint, 2024.

J. Luk. Singularities in general relativity. In *International Congress of Mathematicians 2022 July 6-14*, pages 4120–4141. EMS Press, 2023.

J. Luk, G. Moschidis. On the non-existence of trapped surfaces under low-regularity bounds, arXiv:2204.09855, *Pure and Applied Mathematics Quarterly*, 20:4, 2024.

J. Luk, S.-J. Oh and Y. Shlapentokh-Rothman. A scattering theory approach to Cauchy horizon instability and applications to mass inflation, arXiv:2201.12294, *Annales Henri Poincaré*, 24:363–411, 2023.

S. Chaturvedi and J. Luk. Phase mixing for solutions to 1D transport equation in a confining potential, arXiv:2109.12402, *Kinetic and Related Models*, 15(3):403–416, 2022.

J. Luk and S.-J. Oh. Global nonlinear stability of large dispersive solutions to the Einstein equations, arXiv:2108.13379, *Annales Henri Poincaré*, 23:2391–2521, 2022.

J. Luk and J. Speck. The stability of simple plane-symmetric shock formation for 3D compressible Euler flow with vorticity and entropy, arXiv:2107.03426, *Analysis and PDE*, 17(3): 831–941, 2024.

J. Luk and M. Van de Moortel. Nonlinear interaction of three impulsive gravitational waves II: the wave estimates, arXiv:2107.03426, *Annals of PDE*, 9:10, 2023

S. Chaturvedi, J. Luk and T. T. Nguyen. The Vlasov–Poisson–Landau system in the weakly collisional regime, arXiv:2104.05692, *Journal of American Mathematical Society*, 30:4, 2023.

J. Luk and M. Van de Moortel. Nonlinear interaction of three impulsive gravitational waves I: main result and the geometric estimates, arXiv:2101.08353, *preprint*, 2021.

J. Luk and I. Rodnianski. High-frequency limits and null dust shell solutions in general relativity, arXiv:2009.08968, *preprint*, 2020.

G. Fournodavlos and J. Luk. Asymptotically Kasner-like singularities, arXiv:2003.13591, *American Journal of Mathematics*, 145:4, 2023.

C. Huneau and J. Luk. Trilinear compensated compactness and Burnett's conjecture in general relativity, arXiv:1907.10743, *Annales Scientifiques de l'École Normale Supérieure*, 2:57, 2024.

J. Luk. Stability of vacuum for the Landau equation with moderately soft potentials, arXiv:1807.07551, *Annals of PDE*, 5:11, 2019.

M. Dafermos and J. Luk. The interior of dynamical vacuum black holes I: The C^0 stability of

the Kerr Cauchy horizon, *Annals of Mathematics* 202(2):309-630, 2025.

D. Gajic and J. Luk. The interior of dynamical extremal black holes in spherical symmetry, arXiv:1709.09137, *Pure and Applied Analysis* 1(2):263–326, 2019.

C. Huneau and J. Luk. High-frequency backreaction for the Einstein equations under polarized U(1) symmetry, arXiv:1706.09501, *Duke Mathematical Journal* 67(18):3315–3402, 2018.

C. Huneau and J. Luk. Einstein equations under polarized U(1) symmetry in an elliptic gauge, arXiv:1706.09499, *Communications of Mathematical Physics* 361(3):873–949, 2018.

J. Luk, S.-J. Oh and S. Yang. Dynamical black holes with prescribed masses in spherical symmetry, arXiv:1702.05716, *Proceeding of the Seventh International Congress of Chinese Mathematicians II*, 367–387, Advanced Lectures in Mathematics (ALM), 2019.

J. Luk and S.-J. Oh. Strong cosmic censorship in spherical symmetry for two-ended asymptotically flat initial data II. The exterior of the black hole region, arXiv:1702.05716, *Annals of PDE*, 5(6), 2019.

J. Luk and S.-J. Oh. Strong cosmic censorship in spherical symmetry for two-ended asymptotically flat initial data I. The interior of the black hole region, arXiv:1702.05715, *Annals of Math* 190(1):1–111, 2019.

J. Luk and J. Speck. Shock formation in solutions to the 2D compressible Euler equations in the presence of non-zero vorticity, arXiv:1610.00737, *Inventiones Mathematicae* 214(1):1–169, 2018.

J. Luk and J. Speck. The hidden null structure of the compressible Euler equations and a prelude to applications, arXiv:1610.00743, *Journal of Hyperbolic Differential Equations* 17(1):1–60, 2020.

J. Luk, S.-J. Oh and S. Yang. Solutions to the Einstein-scalar-field system in spherical symmetry with large bounded variation norms, arXiv:1605.03893, *Annals of PDE*, 4:3, 2018.

J. Speck, G. Holzegel, J. Luk and W. W.-Y. Wong. Stable shock formation for nearly plane symmetric waves, arXiv:1601.01303, *Annals of PDE*, 2:10, 2016.

J. Luk and J. Sbierski. Instability results for the wave equation in the interior of Kerr black holes, arXiv:1512.08259, *Journal of Functional Analysis* 271(7):1948-1995, 2016.

G. Holzegel, J. Luk, J. Smulevici and C. Warnick. Asymptotic properties of linear field equations in anti-de Sitter space, arXiv:1502.04965, *Communications of Mathematical Physics* 374(2):1125–1178, 2020.

J. Luk and S.-J. Oh. Proof of linear instability of the Reissner-Nordström Cauchy horizon under scalar perturbations, arXiv:1501.04598, *Duke Mathematical Journal* 166(3):437–493, 2017.

X. An and J. Luk. Trapped surfaces in vacuum arising from mild incoming radiation, arXiv:1409.6270, *Advances in Theoretical and Mathematical Physics* 21(1):1–120, 2017.

J. Luk and R. M. Strain. Strichartz estimates and moment bounds for the relativistic Vlasov-Maxwell system, arXiv:1406.0168, arXiv:1406.0169, *Archive for Rational Mechanics and Analysis* 219(1):445–552, 2016.

J. Luk and R. M. Strain. A new continuation criterion for the Vlasov-Maxwell system, arXiv:1406.0165, *Communications of Mathematical Physics* 331(3):1005–1027, 2014.

J. Luk and S.-J. Oh. Quantitative decay rates for dispersive solutions to the Einstein-scalar field system in spherical symmetry, arXiv:1402.2984, *Analysis and PDE.* 8(7):1603–1674, 2015.

J. Luk. Weak null singularities in general relativity, arXiv:1311.4970, *Journal of Americal Mathematical Society* 31:1–63, 2018.

S. Klainerman, J. Luk and I. Rodnianski. A fully anisotropic mechanism for formation of trapped surfaces in vacuum, arXiv:1302.5951, *Inventiones Mathematicae* 194(1):1–26, 2014.

J. Luk and I. Rodnianski. Nonlinear interaction of impulsive gravitational waves for the vacuum Einstein equations, arXiv:1301.1072, *Cambridge Journal of Mathematics* 5(4):435–570, 2017.

J. Luk and I. Rodnianski. Local propagation of impulsive gravitational waves, arXiv:1209.1130, *Communications of Pure and Applied Mathematics* 68(4):511–624, 2015.

J. Luk. On the local existence for the characteristic initial value problem in general relativity, arXiv:1107.0898, *International Mathmatics Research Notices* 20:4625–2678, 2012.

J. Luk. The null condition and global existence for nonlinear wave equations on slowly rotating Kerr spacetimes, arXiv:1009.4109, *Journal of European Mathematical Society* 15(5):1629–1700, 2013.

J. Luk. A vector field method approach to improved decay for solutions to the wave equation on a slowly rotating Kerr black hole, arXiv:1009.0671, *Analysis and PDE* 5(3):553–625, 2012.

J. Luk. Improved decay for solutions to the linear wave equation on a Schwarzschild black hole, arXiv:0906.5588, *Annales Henri Poincare* 11:805–880, 2010.

Graduate students

Saehoon Eo (current)

Miles Cua (current)

Yuefeng Song (current)

Ethan Lu (current)

Sanchit Chaturvedi (PhD 2023, Thesis: Global properties of kinetic plasmas, Courant Instructor, Assistant Professor at Cornell)

Maxime Van de Moortel (PhD 2019, Thesis: Charged scalar fields on Black Hole space-times, Instructor at Princeton, Assistant Professor at Rutgers)

Invited Talks

May 27 2026, Applied math seminar, Stanford University.

May 20 2026, General Relativity Conference on Singularities and Cosmic Censorship, from Vacuum to Matter, Fields Institute.

May 14 2026, Conference on Singularity Formation and Propagation in Gas Dynamics, Fields Institute.

May 10 2026, May Midwest Microlocal Meeting, Chicago.

January 20 2026, Leipzig General Relativity & PDE seminar, Universität Leipzig.

January 14 2026, Conference on Partial Differential Equations, Analysis and Geometry, Institut des Hautes Études Scientifiques.

September 1 2025, Workshop on Modern Trends in Gravity and Black Holes, University of Crete.

August 29 2025, Analysis Seminar, University of Edinburgh.

April 11 2025, Workshop on Hyperbolic and Dispersive Equations on Curved Geometries: Connections to Physics and General Relativity, Simons Center for Geometry and Physics.

April 4 2025, Analysis Seminar, University of Rochester.

April 3 2025, Colloquium, University of Rochester.

March 28 2025, Workshop on Kinetic Theory and Fluids, University of Wisconsin–Madison.

January 7 2025, Workshop on Black Holes, Naked Singularities, Shocks and Implosions, National University of Singapore.

December 29 2024, Colloquium, Institute of Mathematical Sciences, Chinese University of Hong Kong.

August 8 2024, Workshop on mathematical general relativity, Oberwolfach.

June 24 2024, Nonlinear waves and fluids, University College London.

June 20 2024, Thematic program on Nonlinear Waves and Relativity, Erwin Schrödinger Institute.

April 12 2024, Colloquium, Rutgers University.

April 11 2024, Analysis Seminar, Courant Institute, New York University.

April 10 2024, Departmental Colloquium, University of Toronto.

April 3 2024, Department Colloquium, Princeton University.

October 26 2023, Workshop on recent advances in nonlinear PDEs and their applications, Chinese University of Hong Kong.

October 11 2023, Workshop on nonlinear aspects of general relativity, Princeton Center for Theoretical Science.

July 11 2023, Workshop on Spectral Theory and Mathematical Relativity, Erwin Schrödinger Institute.

July 3 2023, Colloquium, Institute of Mathematical Sciences, Chinese University of Hong Kong.

June 2 2023, Workshop on singularity formation in general relativity and dispersive PDEs, International Centre for Mathematical Sciences, Edinburgh.

April 10 2023, Differential geometry seminar, UC Berkeley.

October 25 2022, Colloquium, Beijing international center for mathematical research (via zoom).

September 30 2022, Clay mathematics institute workshop on stability and instability in general relativity, Oxford University.

July 7 2022, Mathematical physics section, International Congress of Mathematicians (via zoom).

April 5 2022, Workshop on general relativity, Harvard University (via zoom).

February 15 2022, Workshop on mathematical perspectives of gravitation beyond the vacuum regime, Erwin Schrödinger Institute (via zoom).

January 11 2022, Frontiers in analysis of kinetic equations, Isaac Newton Institute for Mathematical Sciences, Cambridge (via zoom).

November 1 2021, New Trends in Geometric PDEs, Westfälische Wilhelms-Universität Münster (via zoom).

October 25 2021, Workshop II: Mathematical and Numerical Aspects of Gravitation, Program on Mathematical and Computational Challenges in the Era of Gravitational Wave Astronomy, IPAM, UCLA.

September 13 2021, Mathematical and Computational Challenges in the Era of Gravitational Wave Astronomy Opening Day, IPAM, UCLA.

August 31 2021, Workshop on mathematical general relativity, Oberwolfach (via zoom).

June 4 2021, Colloquium, Peking University (via zoom).

February 23 2021, Online talks on mathematical perspectives of gravitation beyond the vacuum regime, Erwin Schrödinger Institute (via zoom).

February 17 2021, Applied math seminar, Stanford University (via zoom).

February 12 2021, General relativity seminar, CMSA, Harvard University (via zoom)

February 1 2021, Computational and Applied Mathematics Colloquium, Penn State University (via zoom).

December 28 2021, Annual meeting of the International Consortium of Chinese Mathematicians, Hefei (via zoom).

December 14-15 2020, MAFRAN Winter School: Particle systems, PDEs and Inequalities, Cambridge University (via zoom).

November 2 2020, Virtual Seminar Series, Gravity Initiative, Princeton University (via zoom).

October 22 2020, Department Colloquium, Stanford University (via zoom).

October 13 2020, Colloquium, Black Hole Initiative, Harvard University (via zoom).

October 6 2020, Workshop on Mathematical and Computational Approaches for Solving the Source-Free Einstein Field Equations, ICERM, Brown University (via zoom).

September 22 2020, Harmonic analysis and differential equations student seminar (HADES), UC Berkeley (via zoom).

September 21 2020, Analysis and PDE seminar, UC Berkeley (via zoom).

August 13 2020, MATH–IMS Joint Colloquium, Chinese University of Hong Kong (via zoom).

May 6 2020, Seminar, Universität Wien (via zoom).

April 8 2020, Applied math seminar, Stanford University (via zoom).

March 17 2020, KIPAC tea talk, Stanford University (via zoom).

February 4 2020, Analysis and PDE seminar, University of Kentucky.

November 10 2019, Special session on geometric partial differential equations and their applications, AMS Sectional Meeting, UC Riverside.

November 3 2019, Southern California analysis and PDE conference, UCSD.

October 7 2019, Colloquium, Center for Applied Mathematical Sciences, USC.

September 19 2019, Colloquium, Vanderbilt University.

August 1 2019, Workshop on Time-like Boundaries in General Relativistic Evolution Problems, Casa Mathemática Oaxaca.

July 11 2019, Conference in Partial Differential Equations and Applications, Michigan center for applied and interdisciplinary mathematics, University of Michigan.

July 9 2019, Plenary talk, GR22 Conference, Valencia.

May 10 2019, PDE and Applied Math Seminar, UC Davis.

May 3 2019, Caltech/UCLA joint analysis seminar, Caltech.

April 13, 14 2019, Twenty-second Riviere–Fabes Symposium on Analysis and PDE, University of Minnesota.

April 11 2019, Weak Gravity and Cosmic Censorship: Conjectures and Connections, The Gravity Initiative Spring Conference, Princeton University.

March 11 2019, Analysis and PDE seminar, University of Wisconsin–Madison.

October 17 2018, Applied math seminar, Stanford University.

September 10 2018, Analysis seminar, Princeton University.

September 7 2018, Geometry and analysis seminar, Columbia University.

September 5 2018, Colloquium, Columbia University.

August 6 2018, Workshop on mathematical general relativity, Oberwolfach.

June 1 2018, International conference on mathematical general relativity, IHP.

May 28 2018, Workshop on geometric analysis, International Centre for Mathematical Sciences, Edinburgh.

March 27 2018, PDE Seminar, Penn State University.

February 7 2018, Applied math seminar, Stanford University.

January 10 2018, Conference on recent trend in PDEs, King's College London.

December 15 2017, International conference on wave equations and general relativity, Chinese University of Hong Kong.

November 17 2017, Caltech/UCLA joint analysis seminar, UCLA.

November 13 2017, Differential geometry seminar, UC Berkeley.

November 4 2017, Special session on geometric partial differential equations and their applications, AMS Sectional Meeting, UC Riverside.

April 21 2017, Joint UCI-UCR-UCSD southern California differential geometry seminar, UC Riverside.

March 9 2017, Colloquium, UCSD.

February 28 2017, Colloquium, Black Hole Initiative, Harvard University.

February 27 2017, Analysis Seminar, Princeton University.

February 23 2017, Workshop on geometric transport equations in general relativity, Erwin Schrödinger Institute.

February 6 2017, Bay area microlocal analysis seminar, UC Berkeley.

December 3 2016, Bay area differential geometry seminar, Stanford University.

November 17 2016, Analysis and geometry seminar, UCSC.

October 3 2016, Analysis and PDE seminar, Stanford University.

August 2016, Invited Lecture, International Congress of Chinese Mathematicians, Beijing.

August 2016, Seminar, Peking University.

August 2016, Analysis minicourse series, Yau Mathematical Sciences Center.

July 2016, Workshop on Wave Equation, Chinese University of Hong Kong.

November 2015, International Conference on Mathematical General Relativity - A Celebration of the 100th Anniversary of General Relativity, Institut Henri Poincaré.

November 2015, Conference in celebration of 100 years of general relativity, ETH.

July 2015, Workshop on Mathematical General Relativity, Oberwolfach.

July 2015, Minisymposium on Mathematical General Relativity, EquaDiff 2015, Lyon.

June 2015, International Conference on Black Holes - Focus Program for the Centenary of Einstein's Equations of General Relativity, Fields Institute.

May 2015, Differential Geometry and General Relativity Seminar, KTH.

April 2015, Department Colloquium, Stanford University.

April 2015, Analysis & PDE Seminar, Stanford University

March 2015, Mini-symposium on Analysis of Nonlinear PDEs, Joint British Mathematical Colloquium & British Applied Mathematics Colloquium 2015, Cambridge University.

February 2015, Geometry and Analysis Seminar, Imperial College London.

December 2014, Paris-London Analysis Seminar, IHP.

November 2014, Seminar on Mathematical General Relativity, Jussieu.

November 2014, PDE Seminar, Oxford University.

November 2014, HEP-GR Colloquium, DAMTP, Cambridge University.

November 2014, Workshop on Asymptotics for Nonlinear Geometric PDEs, Centro di Ricerca Matematica Ennio De Giorgi.

October 2014, Analysis Seminar, University of Warwick.

October 2014, Geometric Analysis Seminar, Fields Institute.

October 2014, Analysis Seminar, University of Edinburgh.

July 2014, Seminar, Zhejiang University.

April 2014, PDE and Differential Geometric Seminar, University of Connecticut.

April 2014, Analysis Seminar, University of Pennsylvania.

January 2014, DPMMS Seminar, Cambridge University.

January 2014, Workshop on Nonlinear Wave Equations and General Relativity, Oxford University.

November 2013, Initial Data and Evolution Problems in General Relativity, MSRI.

September 2013, PDE/Analysis Seminar, MIT.

July 2013, GR20 Conference, Warsaw.

July 2013, Research Program in Geometric Analysis, PCMI.

May 2013, Conference on Nonlinear Wave Equations, Institut Henri Poincaré.

April 2013, Analysis and PDE Seminar, Johns Hopkins University.

February 2013, Analysis Seminar, University of Toronto.

December 2012, Workshop in General Relativity, University of Miami.

December 2012, General Relativity Seminar, Columbia University.

December 2012, Analysis Seminar, Courant Institute, New York University.

September 2012, Analysis Seminar, University of Pennsylvania.

September 2012, International Conference on Nonlinear Partial Differential Equations, Oxford University.

July 2012, Workshop on Mathematical General Relativity, Oberwolfach.

May 2012, Workshop on Nonlinear Evolution Equations, Oberwolfach.

May 2012, Evolution Equations: a Conference in Honor of Terence Tao, Northwestern University.

February 2012, Joint Geometric Analysis-PDE/Analysis Seminar, MIT.

January 2012, Workshop on Collapse in General Relativity, University of Miami.

October 2011, PDE Seminar, Cambridge University.

October 2011, Analysis Seminar, Princeton University.

May 2011, 30 Minutes Short Talk, Barrett Memorial Lectures, University of Tennessee at Knoxville.

April 2011, Scattering and Spectral Theory Seminar, Purdue University.

November 2010, Analysis Seminar, University of North Carolina at Chapel Hill.

January 2010, Special Session on Mathematical Challenges of Relativity, AMS Joint Mathematics Meetings, San Francisco.

October 2009, Special Session on General Relativity and Related PDEs, AMS Sectional Meeting, Boca Raton.

Teaching

Instructor, Math 205C Topics in Harmonic Analysis, Stanford University, Spring 2025.

Instructor, Math 272 Topics in PDEs, Stanford University, Winter 2022.

Instructor, Math 220/220A PDEs in Applied Mathematics, Stanford University, Fall 2019, 2022, 2024.

Instructor, Math 61CM Modern Mathematics: Continuous Methods, Stanford University, Fall 2019, 2021, 2023, 2025.

Instructor, Math 215C Differential Geometry, Spring 2019.

Instructor, Math 256A PDEs, Stanford University, Autumn 2018, Spring 2020, 2021.

Instructor, Math 205B Real Analysis, Stanford University, Winter 2018, 2022, 2024.

Instructor, Math 63CM Modern Mathematics: Continuous Methods, Stanford University, Spring 2017, 2018, 2023, Summer 2021.

Instructor, Math 256B Topics in PDEs, Stanford University, Autumn 2016.

Instructor, Math 175 Elementary Functional Analysis, Stanford University, Autumn 2016.

Lecturer, Nonlinear Wave Equations, Part III, Cambridge University, Lent 2015, Lent 2016.

Lecturer, Linear Analysis, Part II, Cambridge University, Michaelmas 2015.

Teaching Assistant, Analysis 18.100C, MIT, Spring 2014.

Assistant in Instruction, Geometry of General Relativity, Princeton, Summer 2011.

Instructor, Linear Algebra, Princeton, Spring 2011.

Assistant in Instruction, Complex Analysis, Princeton, Fall 2010.

Instructor, Calculus, Princeton, Fall 2009.

Service

Editor, Analysis and PDE (2025-)

Editor, Journal of hyperbolic differential equations (2023-)

Editor, Analysis and mathematical physics (2022-)

Editor, Potential analysis (2020-)

Organizer of 3rd Simons Math Summer Workshop: Partial Differential Equations of Classical

Physics, Simons Center for Geometry and Physics (July 2025)

Organizer of General Relativity Session, 21st International Congress of Mathematical Physics, Strasbourg (July 2024)

Co-organizer of Focus week on Singularities in General Relativity, Focus Program on 100 Years of General Relativity, Fields Institute (June 2015)

Co-organizer of Workshop on Naked Singularities, Princeton (March 2012).

Mentor, Mentoring Moebius, Princeton (Fall 2010-June 2012).

Co-organizer of the Graduate Student Seminar, Princeton (Spring 2009).

Grants

NSF grant DMS-2304445 "Mathematical Problems in General Relativity" (2023-)

NSF grant DMS-2005435 "Mathematical Problems in General Relativity" (2020-2025)

NSF grant DMS-1709458 "Singularities in General Relativity" (2017-2020)

NSF postdoctoral research fellowship, DMS-1204493 (2012-2015)

Awards

Bôcher prize (January 2026)

International Consortium of Chinese Mathematicians Best Paper Award (December 2020)

Sloan Fellowship (2017-2019)

Terman Fellowship (2016-2019)

Silver prize of the New World Mathematics Award for PhD thesis.

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