

# Yi Liu

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## Research Interests

Topology of 3-manifolds, hyperbolic geometry

## Education

B.S. Mathematics, Peking University, China, 2006

Ph.D. Mathematics, University of California at Berkeley, 2012  
Dissertation Advisor: Ian Agol

## Employment

July 2020—present, Professor, Beijing International Center for Mathematical Research, Peking University

July 2015—June 2020, Associate Professor, Beijing International Center for Mathematical Research, Peking University

September 2012—June 2015, Taussky–Todd Instructor, Department of Mathematics, California Institute of Technology

## Awards, Honors, and Grants

National Science Fund for Distinguished Young Scholars, China 2020–2024

Qiu Shi Outstanding Young Scholar Award, China 2017–2019

The Recruitment Program of Global Youth Experts, China 2016–2018

NSF Grant No. DMS-1308836, Principle Investigator, USA 2013–2016

Herb Alexander Prize for Outstanding Dissertation, USA 2012

## Selected Invited Talks

Knot groups onto hyperbolic knot groups. *The 8th Annual Graduate Student Topology and Geometry Conference*, Ann Arbor, USA, April 2010.

Presentation length and drillings. *Summer Workshop on 3-Manifold Topology*, Changchun, China, July 2010.

Factorizing homomorphisms through extended Dehn fillings. *Wasatch Topology Conference*, Park City, USA, December 2010.

Presentation length and Simon's conjecture. Plenary talk. *The 7th East Asian School of Knots and Related Topics*, Higashi Hiroshima, Japan, January 2011.

Virtual positivity of representation volumes. *The Joint Los Angeles Topology Seminar*, Pasadena, USA, February 2013.

Bounded quasi-Fuchsian subsurfaces in closed hyperbolic 3-manifolds. *MSRI Hot Topics Workshop: Surface subgroups and cube complexes*, Berkeley, USA, March 2013.

Introduction on Virtual Haken Conjecture. Short course. *Summer School and Conference: Low Dimensional Topology*, Dalian, China, July 2013.

Bounded quasi-Fuchsian surfaces in closed hyperbolic 3-manifolds. Plenary Talk. *A Satellite Conference of Seoul ICM: Knots and Low Dimensional Manifolds*, Busan, Korea, August 2014.

Aspirality and separability for surface subgroups in 3-manifold groups. *IAS Workshop on Geometric structures on 3-manifolds*, Princeton, USA, October, 2015.

On the  $L^2$ -Alexander torsion of 3-manifolds, *HIM Workshop: New directions in  $L^2$ -invariants*, Bonn, Germany, October 2016.

Virtual constructions in closed hyperbolic 3-manifolds, *Oberwolfach Workshop on Surface bundles*, Oberwolfach, Germany, December 2016.

Representation volume and higher dimensional geometries. *The 4th Russian-Chinese Conference on Knot Theory and Related Topics*, Moscow, Russia, July 2017.

## Teaching Experience

Spring 2022, Geometry II (Honored), Instructor, Peking U

Fall 2021, Geometry I (Honored), Instructor, Peking U

Spring 2021, Low-Dimensional Topology, Instructor, Peking U

Fall 2020, Geometry I (Honored), Instructor, Peking U

Spring 2020, Introduction to hyperbolic geometry, Instructor, Peking U

Fall 2019, Geometry I (Honored), Instructor, Peking U

Spring 2019, Fiber Bundles and Characteristic Classes, Instructor, Peking U

Fall 2018, Geometry I (Honored), Instructor, Peking U

Spring 2018, Freshmen geometry seminar (curriculum course), Organizer, Peking U

Fall 2017, Introduction of Core Mathematics II (topology part), Lecturer, Peking U

Fall 2017, Geometry I (Honored), Instructor, Peking U

Spring 2017, Introduction to hyperbolic geometry, Instructor, Peking U

Fall 2016, Introduction of Core Mathematics II (topology part), Lecturer, Peking U

Fall 2016, Geometry I (Honored), Instructor, Peking U  
 Spring 2016, Introduction to hyperbolic geometry, Instructor, Peking U  
 Spring 2015, MATH 151c Algebraic and differential topology, Instructor, Caltech  
 Winter 2015, MATH 191 Virtual properties of 3-manifolds, Instructor, Caltech  
 Spring 2014, MATH 151c Algebraic and differential topology, Instructor, Caltech  
 Winter 2014, MATH 151b Algebraic and differential topology, Instructor, Caltech  
 Fall 2013, MATH 151a Algebraic and differential topology, Instructor, Caltech  
 Spring 2013, MATH 151c Algebraic and differential topology, Instructor, Caltech  
 Winter 2013, MATH 151b Algebraic and differential topology, Instructor, Caltech  
 Spring 2012, MATH 053 Multivariable calculus, Graduate Student Instructor (GSI), UC Berkeley  
 Spring 2009, MATH 054 Linear algebra and differential equations, GSI, UC Berkeley  
 Fall 2008, MATH 001B Calculus II, GSI, UC Berkeley  
 Spring 2008, MATH 001B Calculus II, GSI, UC Berkeley  
 Fall 2007, MATH 054 Linear algebra and differential equations, GSI UC Berkeley  
 Spring 2007, MATH 001B Calculus II, GSI, UC Berkeley  
 Fall 2006, MATH 185 Complex Analysis, Reader, UC Berkeley

## Research Papers

*Mapping classes are almost determined by their finite quotient actions*, Duke Math. J., to appear, 2022: arXiv:1906.03602

*Finite quotients, arithmetic invariants, and hyperbolic volume*, preprint, 36 pages, 2021: arXiv:2105.01022  
*Finite-volume hyperbolic 3-manifolds are almost determined by their finite quotient groups*, preprint, 47 pages, 2020: arXiv:2011.09412

*Finiteness of nonzero degree maps between 3-manifolds*, J. Topol, **13** (2020), 237–268: doi:10.1112/topo.12125

*Virtual homological spectral radii for automorphisms of surfaces*, J. Amer. Math. Soc. **33** (2020), 1167–1227: doi:10.1090/jams/949

Joint with Pierre Derbez, Hongbin Sun, and Shicheng Wang, *Volume of representations and mapping degree*, Adv. Math. **351** (2019), 570–613: doi:10.1016/j.aim.2019.05.015

*Immersing quasi-Fuchsian surfaces of odd Euler characteristic in closed hyperbolic 3-manifolds*, J. Differ. Geom. **111** (2019), 475–493: doi:10.4310/jdg/1552442607

Joint with Hongbin Sun, *Virtual 1-domination of 3-manifolds*, Compos. Math. **154** (2018), 621–639: doi:10.1112/S0010437X17007965

Joint with Pierre Derbez, Hongbin Sun, and Shicheng Wang, *Positive simplicial volume implies virtually positive Seifert volume for 3-manifolds*, Geom. Topol. **21** (2017), 3159–3190: doi:10.2140/gt.2017.21.3159

*Degree of  $L^2$ -Alexander torsion for 3-manifolds*, *Invent. Math.* **207** (2016), 981–1030:  
doi:10.1007/s00222-016-0680-6

*A characterization of virtually embedded subsurfaces in 3-manifolds*, *Trans. Amer. Math. Soc.* **369** (2017), 1237–1264, with erratum, 1513–1515: doi:10.1090/tran/6707

Joint with Pierre Derbez and Shicheng Wang, *Chern–Simons theory, surface separability, and volumes of 3-manifolds*, *J. Topol.* **8** (2015), 933–974: doi:10.1112/jtopol/jtv023

Joint with Vladimir Markovic, *Homology of curves and surfaces in closed hyperbolic 3-manifolds*, *Duke Math. J.* **164** (2015), 2723–2808.

Joint with Yi Ni, Hongbin Sun, and Shicheng Wang, *On slope genera of knotted tori in the 4-space*, *Pacific J. Math.* **261** (2013), no. 1, 117–144.

*Virtual cubulation of nonpositively curved graph manifolds*, *J. Topol.* **6** (2013), 793–822:  
doi:10.1112/jtopol/jtt010.

*A Jørgensen–Thurston theorem for homomorphisms*, *Algebr. Geom. Topol.* **12** (2012), 1301–1311.

Joint with Ian Agol, *Presentation length and Simon’s conjecture*. *J. Amer. Math. Soc.* **25** (2012), 151–187.

Joint with Fan Ding, Shicheng Wang, and Jiangang Yao, *Extending  $T^p$  automorphisms over  $\mathbb{R}^{p+2}$  and realizing DE attractors*, *Discrete Contin. Dyn. Syst.* **32** (2012), 1639–1655.

Joint with Fan Ding, Shicheng Wang, and Jiangang Yao, *Spin structure and codimension-two homeomorphism extensions*, *Math. Res. Lett.* **19** (2012), 345–357.