

Henry Liu

Curriculum Vitae

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Department of Mathematics
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Research interests

Algebraic geometry, geometric representation theory, and mathematical physics, with a focus on enumerative geometry (e.g. Gromov–Witten, Donaldson–Thomas, quasimap theories).

Education

Candidate for Ph.D. in Mathematics Fall 2016 – present
Columbia University, New York, NY, USA

Advisor: Andrei Okounkov

Bachelor of Mathematics Fall 2012 – Spring 2016
University of Waterloo, Waterloo, Ontario, Canada

Honours Pure Mathematics and Honours Computer Science, With Distinction - Dean's Honours List

Publications and preprints

- [1] Henry Liu. Quasimaps and stable pairs. *submitted*, June 2020. arXiv:2006.14695.
- [2] Henry Liu. Self-duality in quantum K-theory. *submitted*, June 2019. arXiv:1906.10824.
- [3] Gabriel Coutinho and Henry Liu. No Laplacian perfect state transfer in trees. *SIAM J. Discrete Math.*, 29(4):2179–2188, 2015.
- [4] Henry Liu, Mingbin Xu, Ziting Yu, Vincent Corvinelli, and Calisto Zuzarte. Cardinality estimation using neural networks. In *Proceedings of the 25th Annual International Conference on Computer Science and Software Engineering*, CASCON '15, pages 53–59, USA, 2015. IBM Corp.

Honors and awards

Columbia Dean's Fellow Fall 2016 – Spring 2021

NSERC Undergraduate Student Research Award Fall 2015

IBM CASCON 2015 Best Student Paper November 2015

NSERC Undergraduate Student Research Award Summer 2014

University of Waterloo Mathematics National Scholarship Fall 2012 – Spring 2016

University of Waterloo Dean's Honour List
University of Waterloo President's Scholarship

Fall 2012 – Spring 2016
Fall 2012

Research talks

Self-duality in quantum K-theory CUHK, Harvard, YMSC, Oct 2020
Joint Differential Geometry seminar
Computational aspects of Donaldson–Thomas theory Columbia, Oct 2020
Informal mathematical physics seminar
Quasimaps and BPS counts, Mathematical physics seminar Perimeter, Oct 2020
Quasimaps and stable pairs, Informal mathematical physics seminar Columbia, June 2020
Perfect state transfer on graphs Waterloo, Jul 2014
Combinatorics & Optimization undergraduate research seminar

Teaching

Instructor for *Ordinary Differential Equations* Summer 2019
Instructor for *Calculus I* Spring 2019
Instructor for *Geometry and Topology* and *Representation Theory and Physics* Columbia Science Honors Program Fall 2016 – present
TA for *Making, Breaking Codes* Fall 2020
Section leader for *Undergraduate Seminar on Knot Theory* Spring 2020
TA for *Ordinary Differential Equations* Fall 2019
TA for *Linear Algebra* Fall 2018
TA for *Intro to Modern Algebra II* Spring 2018
TA for *Intro to Modern Algebra I* Fall 2017
TA (undergrad) for *Linear Algebra I, Calculus II, III, Intro to Combinatorics* Fall 2013 – Spring 2015

Service and organization

Mentor for the Columbia *Directed Reading Program* for undergraduate students Fall 2020
Co-organizer for *student learning seminar* on category \mathcal{O} Summer 2020
Organizer for *student learning seminar* on conformal field theory Fall 2019
Organizer for *student learning seminar* on symplectic duality Spring 2019
Co-organizer for *enumerative geometry seminar* on the GW/DT correspondence Fall 2018
Co-organizer for *graduate student enumerative geometry seminar* Fall 2017
Co-organizer for *student seminar on QFT, string theory, and mirror symmetry* Fall 2015 – Summer 2016

Conferences and schools attended

QFT for Mathematicians 2020	Perimeter Institute, postponed
Geometry and Physics XVII	PIMS, postponed
Quantum structures in Algebra and Geometry	Northeastern, Aug 2019
International Summer School on Mathematical Physics	Skoltech, Jul 2019
QFT for Mathematicians	Perimeter Institute, Jun 2019
Elliptic Cohomology Days	UIUC, Jun 2019
Geometric Representation Theory and Equivariant Elliptic Cohomology	AMS MRC, Jun 2019
Algebraic Geometry Northeastern Series	Brown, Sep 2018
Séminaire de mathématiques supérieures: Derived Geometry and Higher Categorical Structures in Geometry and Physics	Fields Institute, Jun 2018
Structures in Enumerative Geometry	MSRI, Mar 2018
Enumerative Geometry beyond numbers Workshop	MSRI, Jan 2018
Algebraic Geometry Northeastern Series	Northeastern, Oct 2017
Algebraic Geometry Northeastern Series	Stony Brook, Apr 2017

Expository talks

<i>AGT correspondence</i> , Student learning seminar on conformal field theory	Nov 2019
<i>Symplectic resolutions</i> , Student learning seminar on symplectic duality	Mar 2019
<i>Capping and quantum differential equation</i> , Enumerative geometry seminar	Dec 2018
<i>Excess intersections</i> , Student intersection theory seminar	Nov 2018
<i>Vertex operators and Kniznik–Zamolodchikov equations</i> Columbia Undergraduate Math Society	Oct 2018
<i>Gromov–Witten theory of local curves</i> , Enumerative geometry seminar	Oct 2018
<i>TQFTs and gauge theories</i> , Columbia Undergraduate Math Society	Feb 2018
<i>Bridgeland stability</i> , Graduate student algebraic geometry seminar	Nov 2017
<i>Moduli of sheaves on K3 surfaces</i> , Graduate student algebraic geometry seminar	Oct 2017
<i>13/2 ways to count curves</i> , Graduate student enumerative geometry seminar	Sep 2017
<i>Intersection cohomology</i> , Graduate student algebraic geometry seminar	Jan 2017
<i>The cohomology ring $H^*(G_n; \mathbb{Z}/2)$ and the existence of Stiefel–Whitney classes</i> Graduate student seminar on characteristic classes	Sep 2016
<i>The number of degree-d curves passing through $3d - 1$ points on the plane</i> Canadian Undergraduate Mathematics Conference	Jun 2016
<i>Mathematical foundations of quantum mechanics</i> Canadian Undergraduate Mathematics Conference	Jun 2015

Industry experience

LinkedIn Software Engineering Intern

Summer 2015

IBM EPIC Software Engineering Intern

Summer 2013

Patents

Vincent Corvinelli, Henry Liu, Mingbin Xu, Ziting Yu, and Calisto Zuzarte. *Selectivity estimation using artificial neural networks*. United States Patent US 10,318,866. June 11, 2019.

Languages

Native: English.

Fluent (non-technical): Mandarin Chinese.

Elementary: French.

Technology (> 5 years experience): C/C++, Python, SageMath, L^AT_EX.