Jonathan Hanselman

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Research interests

I am interested in low-dimensional topology, in particular the topology of 3-manifolds and knots. I primarily study these objects using Heegaard Floer homology and other techniques related to symplectic geometry. I am especially interested in questions concerning decomposing manifolds or knots through cutting and gluing procedures.

Appointments

Assistant Professor, Princeton University	September 2017-Present*
RTG Instructor, University of Texas at Austin	August 2014-August 2017

*During this period I took two semester long pauses in teaching and research, each to be primary caretaker for a new child

Education

Columbia University	**New York, NY**
Ph.D. Mathematics	2014
M.A. Mathematics	2010
Massachusetts Institute of Technology	**Cambridge, MA**
B.S. Mathemtaics	2009
B.S. Physics	2009

Awards and honors

NSF Grant No. DMS-2105501, "Floer homology and immersed curve invariants in low dimensional topology", Principle Investigator, 2021 - 2024.

NSF Grant No. DMS-1711926, "Low Dimensional Topology via Bordered Floer Theory", Principle Investigator, 2017 - 2020.

250th Anniversary Fund for Innovation in Undergraduate Education Grant, 2019

Mathematics Department Junior Faculty Teaching Award, 2018-2019

Publications and Preprints

d-invariants of double branched covers, signatures, plumbing links, and bordered Floer theory
Joint with M. Marengon and B. Wong. (In preparation)

Knot Floer homology via immersed curves
Joint with W. Chen
Submitted, preprint available arXiv:2309.12297

Knot Floer homology via immersed curves
Submitted, preprint available arXiv:2305.16271

Cabling in terms of immersed curves
Joint with L. Watson
Geom. Topol. 27-3 (2023), 925-952; DOI 10.2140/gt.2023.27.925

Heegaard Floer homology and cosmetic surgeries in S^3
J. Eur. Math. Soc. 25 (2023), no. 5, pp. 1627–1670. DOI 10.4171/JEMS/1218

Heegaard Floer homology for manifolds with torus boundary: properties and examples
Joint with J. Rasmussen and L Watson
Proc. Lond. Math Soc. (3) 2022;1-89. DOI 10.1112/plms.12473

Bordered Floer homology for manifolds with torus boundary via immersed curves
Joint with J. Rasmussen and L Watson
J. Amer. Math. Soc. (to appear) DOI: https://doi.org/10.1090/jams/1029

Taut foliations on graph manifolds
Joint with J. Rasmussen, S. Rasmussen, and L. Watson.
Compositio Mathematica, 156(3), 604-612. DOI: 10.1112/S0010437X19007814

A calculus for bordered Floer homology
Joint with L. Watson
Geom. Topol. 27-3 (2023), 823-924; DOI 10.2140/gt.2023.27.823

A remark on the geography problem in Heegaard Floer homology
Joint with Ç. Kutluhan and T. Lidman.
Proc. Sympos. Pure Math. 102 (2019), 103–111.

Splicing integer framed knot complements and bordered Heegaard Floer homology
Quantum Topol. 8 (2017), 715-748. DOI: 10.4171/QT/100

Bordered Heegaard Floer homology and graph manifolds
Algebr. Geom. Topol. 16-6 (2016), 3103–3166. DOI: 10.2140/agt.2016.16.3103

Teaching

Princeton University

MAT104: Calculus II (Course head)	Fall 2023
Junior Seminar in Knot Theory	Fall 2023
MAT104: Calculus II (Course head)	Spring 2023
MAT104: Calculus II (Course head)	Fall 2022
MAT175: Math for Economics/Life Sciences (Course head)	Spring 2022
MAT175: Math for Economics/Life Sciences (Course head)	Fall 2021

MAT566: Fukaya Categories and Floer Homology of 3-Manifolds	Spring 2020
MAT175: Math for Economics/Life Sciences (Course head)	Fall 2020
MAT104: Calculus II	Spring 2020
Junior Seminar in Knot Theory	Spring 2020
Junior Seminar in Knot Theory	Spring 2019
MAT104: Calculus II (Course head)	Fall 2018
MAT104: Calculus II (Course head)	Spring 2018

Univeristy of Texas at Austin

M343K: Introduction to Algebraic Structures	Spring 2017
M341: Linear Algebra	Fall 2016
M392C: Heegaard Floer homology, techniques and applications	Spring 2016
M328K: Introduction to Number Theory	Fall 2015
M408D: Calculus II	Spring 2015
M408K: Calculus I	Fall 2014

Columbia University

Calculus II	Summer 2013
Calculus I	Spring 2012
Floating substitute for Calculus I and III, Linear Algebra, and Analysis	Summer-Fall 2013

Supervising independent study

Supervised reading course, *Grid homology*	Summer 2020
Supervised reading course, *Floer homology and Fukaya cateogries*	Summer 2019
Mentor for Directed Reading Program at UT Austin, *Knots and Links*	Fall 2016
Teaching Assistant for Columbia, *Non-commutative Knot Invariants*	Summer 2011

Service

Co-organizer of Princeton Geometry/Topology RTG Summer School · Summer 2023

Member of the University Classroom and Schedules committee · Fall 2022-present

Co-organizer of Princeton Topology Seminar · Spring 2018-present

Co-organizer of Princeton Geometry/Topology RTG Summer School · Summer 2018

Co-organizer · Fall 2016
Special Session on Floer Theoretic Invariants of 3-manifolds and Knots
Western Sectional Meeting of the AMS, Denver, CO

Co-organizer · Fall 2016
Special Session on Floer Theoretic Invariants of 3-manifolds and Knots
Western Sectional Meeting of the AMS, Denver, CO

Speaker for Mini Math Camp   Spring 2016
     Outreach event for middle and high school students

Co-organizer of Columbia Symplectic Geometry Seminar   Summer 2013–Spring 2014

Volunteer MathCounts coach at Achievement First Middle School   Fall 2010–Spring 2012.
     Started a MathCounts afterschool program at a new charter school
     Ran weekly meetings to prepare students for annual competition.

Conference Talks

Immersed curve bordered invariants from knot Floer homology
     Tech Topology Summer School
     Georgia Tech, July 2023

Immersed curves and invariants of knots and 3-manifolds
     Minicourse for RTG Summer School in Geometry and Topology
     Princeton University, July 2023

On immersed (1,1)-diagrams
     Special Session on Gauge Theory, Geometric Analysis, and Low-Dimensional Topology
     AMS Sectional Meeting (virtual), March 2022

Knot Floer homology as immersed curves
     Interactions of gauge theory with contact and symplectic topology in dimensions 3 and 4
     Banff International Research Station (virtual workshop), June 2020

Bordered Floer homology and the Fukaya category of the torus
     Symplectic geometry and its interactions with low-dimensional topology
     Princeton, NJ, June 2018

Mini-course: Bordered Floer as immersed curves
     ISM Discovery School: Perspectives on bordered Heegaard Floer Theory
     Montreal, Canada, May 2018

Bordered Floer homology via immersed curves, part 2
     UCLA Topology Workshop, January 2018

Bordered Floer homology via immersed curves: properties and applications
     CMO Workshop: 30 Years of Floer homology for 3-manifolds, Oaxaca, Mexico, August 2017

Bordered Floer homology via immersed curves in the punctured torus
     Special Session on Geometry and Topology in Low Dimensions: Interactions with Floer theory
     CMS Winter Meeting, Niagara Falls, ON, Canada, Dec 2016

Bordered Floer homology via immersed curves in the punctured torus
     Special Session on Low Dimensional Geometry and Topology
     AMS Sectional Meeting, Athens, GA, March 2016

Detecting L-space slopes via bordered Floer homology
     An afternoon in low dimensions, University of Glasgow, March 2015

Splicing integer framed knot complements
     Special Session on Knot Theory and Floer-type Invariants
     AMS Sectional Meeting in East Lansing, MI, March 2015

Splicing integer framed knot complements
   Special Session on Interactions Between Knots and Manifolds
   AMS Sectional Meeting in San Francisco, CA, October 2014

Heegaard Floer homology of graph manifolds
   Special Session on Invariants in Low-Dimensional Topology
   AMS Sectional Meeting in Baltimore, MD, March 2014

Invited Talks

Satellite knots and immersed curves
   Stanford University, October 2023

Satellite knots and immersed curves
   Duke University, June 2023

Immersed curve invariants for knot complements
   Harvard University, November 2022

Obstructing cosmetic surgeries with knot Floer homology
   Stony Brook University, October 2021

The cosmetic surgery conjecture and Heegaard Floer homology
   Chinese University of Hong Kong, October 2021

The cosmetic surgery conjecture and Heegaard Floer homology
   Bosten College, September 2019

The cosmetic surgery conjecture and Heegaard Floer homology
   Princeton University, May 2019

The cosmetic surgery conjecture and Heegaard Floer homology
   Duke University, April 2019

Heegaard Floer invariants for manifolds with torus boundary
   University of British Columbia, November 2018

Heegaard Floer invariants for manifolds with torus boundary via immersed curves
   University of Pennsylvania, October 2018

Heegaard Floer invariants for manifolds with torus boundary
   UT Austin, October 2018

Bordered Heegaard Floer homology and immersed curves in the torus
   Massachusetts Institute of Technology, September 2018

Bordered Heegaard Floer homology and immersed curves in the torus
   Stony Brook University, April 2018

Bordered Heegaard Floer homology with torus boundary via immersed curves
   Princeton University, September 2017

Bordered modules as immersed curve
   Sherbrooke University, September 2016

Bordered Floer homology via immersed curves
   Boston College Geometry/Topology Seminar, April 2016

Bordered Floer homology via immersed curves
Columbia Symplectic Geometry Seminar, April 2016

Bordered Floer homology via immersed curves
Princeton Topology Seminar, April 2016

Bordered Floer homology via immersed curves
University of Glasgow Geometry and Topology Seminar, Mar 2016

L-space graph manifolds and bordered Heegaard Floer homology via immersed curves
Caltech Geometry & Topology, February 2016

L-spaces, taut foliations, and left orderability for graph manifolds
UT Austin Topology Seminar, August 2015

L-space slopes and bordered Heegaard Floer homology
Princeton Topology Seminar, April 2015

Obtaining L-spaces by splicing knot complements
UCLA Topology Seminar, Mar 2015

Obtaining L-spaces by splicing knot complements
Rice University Geometry/Topology Seminar, Feb 2015

Splicing integer framed knot complements
UT Austin Geometry Seminar, Sept 2014

Computing Heegaard Floer homology of graph manifolds
Columbia University, Symplectic Geometry Seminar, October 2013

Bordered Heegaard Floer homology and graph manifolds
UNC-Duke joint Topology Seminar, September 2013