Daniel Halpern-Leistner

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Education:

2007-2013 Ph.D. in Mathematics, University of California, Berkeley.
Advisor: Constantin Teleman
Thesis: "Geometric invariant theory and derived categories of coherent sheaves"

2003-2007 A.B. in Mathematics, Princeton University.
Undergraduate Thesis: "On the algebraic structure of dynamical systems"

Research experience:

2017-	Assistant Professor, Cornell University
2018 Spring	Post Doctoral Fellow, Mathematical Sciences Research Institute
2016-2017	Ritt Assistant Professor, Columbia University.
2013-2016	NSF Postdoctoral Fellow, Columbia University.
2014-2015	Member and NSF Postdoctoral Fellow, Institute for Advanced Study.
2010 Fall	Visiting graduate student, Max Planck Institute for Mathematics, Bonn
2008-2009	Visiting researcher, Stanford University (Applied Physics).

Awards and grants:

2020-	NSF CAREER grant
2019-	Simons Foundation Collaboration Grant
2017-	Visiting Fellowship at the Perimeter Institute for Theoretical Physics
2016-	NSF personal grant in Algebra & Number Theory
2013-2016	NSF Postdoctoral Research Fellowship (MSPRF).
2013	Kenneth Ribet and Lisa A. Goldberg Award in Algebra (thesis prize in algebra).

Research interests:

Moduli problems, derived algebraic geometry, derived categories of coherent sheaves, geometric invariant theory, geometric representation theory

Publications:

1. Halpern-Leistner, Daniel, and Steven V. Sam. "Combinatorial constructions of derived

equivalences." (submitted) *arXiv preprint* *arXiv:1601.02030* (2016).

2. Halpern-Leistner, Daniel, and Daniel Pomerleano. "Equivariant Hodge theory and noncommutative geometry." (submitted) *arXiv preprint* *arXiv:1507.01924* (2015).
3. Bhatt, Bhargav, and Daniel Halpern-Leistner. "Tannaka duality revisited." *Advances in Mathematics* (to appear). *arXiv:1507.01925* (2015)
4. Halpern-Leistner, Daniel, and Ian Shipman. "Autoequivalences of derived categories via geometric invariant theory." *Advances in Mathematics* (to appear). *arXiv:1303.5531* (2013)
5. Halpern-Leistner, Daniel. "The derived category of a GIT quotient." *Journal of the American Mathematical Society* 28, no. 3 (2015): 871-912.

Preprints:

6. Jarod Alper, Harold Blum, Daniel Halpern-Leistner, Chenyang Xu, "Reductivity of the automorphism group of K-polystable Fano varieties." arXiv preprint arXiv:1906.03122 (2019)
7. Alper, Jarod and Daniel Halpern-Leistner and Jochen Heinloth, "Cartan-Iwahori-Matsumoto decompositions for reductive groups." arXiv preprint arXiv: 1903.00128 (2019)
8. Alper, Jarod and Daniel Halpern-Leistner and Jochen Heinloth, "Existence of good moduli spaces for algebraic stacks." *arXiv preprint* *arXiv:1812.01128* (2019).
9. Halpern-Leistner, Daniel. "The equivariant Verlinde formula on the moduli of Higgs bundles." With an appendix by Constantin Teleman. *arXiv preprint* *arXiv:1608.01754* (2016).
10. Halpern-Leistner, Daniel. "Remarks on Theta-stratifications and derived categories." *arXiv preprint* *arXiv:1502.03083* (2015).
11. Halpern-Leistner, Daniel. "On the structure of instability in moduli theory." *arXiv preprint* *arXiv:1411.0627* (2014).
12. Halpern-Leistner, Daniel, and Anatoly Preygel. "Mapping stacks and categorical notions of properness." *arXiv preprint* *arXiv:1402.3204* (2014).
13. Halpern-Leistner, Daniel. "Lefschetz Hyperplane Theorem for Stacks." *arXiv preprint* *arXiv:1008.0891* (2010).

In preparation:

"Yangian actions on derived categories of coherent sheaves", with Davesh Maulik and Andrei Okounkov

> We construct ``stable envelope functors" in equivariant derived categories of coherent sheaves and categorify the results of Maulik & Okounkov's paper ``Quantum groups and quantum cohomology" (arXiv:1211.1287)

"Theta-stratifications and derived categories"

> An extension of "Remarks on Theta-stratifications and derived categories" which will prove that any two birational moduli spaces of Gieseker semistable coherent sheaves on a K3 surface (with primitive Mukai vector and with respect to a generic polarization) have equivalent derived categories of coherent sheaves.

Teaching:

- Cornell University:
  - Spring 2020 - Topics in algebraic geometry (Math 7670)
  - Fall 2019 - Multivariable calculus (Math 1920)
  - Fall 2018 - Linear algebra (Math 2210)
  - Graduate students mentored: Dylan Peifer, Kimoi Kemboi
  - Post doctoral fellows mentored: Harrison Chen
- Columbia University:
  - Spring 2017 - Analysis and optimization
  - Fall 2016 - "Taming moduli problems in algebraic geometry" (graduate topics course in algebraic geometry) - Designed a course which covers geometric representation theory from the point of view of algebraic stacks, and discusses the moduli of G-bundles on a curve in some depth.
  - Summer 2016 - Co-organized the Columbia Research Experience for Undergraduates program on the "properties of random varieties over finite fields."
  - Spring 2016 - Calculus III (Multivariable calculus)
- UC Berkeley:
  - Served as the primary instructor for two courses
    - Spring 2013 - Math 191 (undergraduate topics course) - Designed an upper level undergraduate course on the complex and differential geometry of Riemann surfaces
    - Summer 2009 - Math 1B (second semester calculus)
  - 2007-2013 - served 5 semesters as a Graduate Student Instructor for calculus, multivariable calculus, and linear algebra.

Invited mini-courses and other honors:

ICTS discussion meeting on moduli of bundles and related structures (February 2020)
Beyond geometric invariant theory
University of Bonn (Winter 2019)
Daniel Huybrechts organized a semester-long seminar on my "beyond geometric invariant theory" program.
http://www.math.uni-bonn.de/~georgo/note/BGIT.pdf
Freie Universitaet Berlin (New techniques in GIT conference, September 2015)
Beyond geometric invariant theory
http://userpage.fu-berlin.de/hoskins/workshop_GIT.html
University of Toronto (March 2013)
Master class on geometric invariant theory and derived categories of coherent sheaves,
http://www.math.toronto.edu/rayan/MasterClassSpring13/

Invited lectures:

2020

ICTS, Bangalore India (February)
Beyond geometric invariant theory
Yale University (January)
Harder-Narasimhan theory for gauged maps

2019

Workshop on 3D mirror symmetry and the AGT conjecture, Zhejiang University, Hangzhou China (October)
Infinite dimensional GIT and gauged Gromov-Witten theory
Quantum Structures in Algebra and Geometry, Northeastern University (August)
Infinite dimensional GIT and gauged Gromov-Witten theory
Vector Bundles over Algebraic Curves, at the Center for Quantum Geometry of Moduli Spaces, Aarhus University (June)
Harder-Narasimhan theory for gauged maps
MIT (May)
Stable envelopes
University of Michigan (April)
Stable envelopes
University of Bonn (January)
Beyond geometric invariant theory (2 lectures)

2018

University of Edinburgh (May)
Beyond geometric invariant theory
Stanford University (April)
Wall crossing formulas in Donaldson theory
UC Davis (March)
Beyond geometric invariant theory
MSRI member seminar (February)
Beyond geometric invariant theory

2017

Route 81 conference (October)
Filtrations in moduli problems
Algebraic Geometry Northeastern Series, Northeastern (October)
Beyond geometric invariant theory
Perimeter Institute for Theoretical Physics (October)
Beyond geometric invariant theory
Vector Bundles over Algebraic Curves, Essen (September)
Beyond geometric invariant theory
Helvetic Algebraic Geometry Workshop (June)
Beyond geometric invariant theory, 2 lectures
Massachusetts Institute of Technology (May)
Equivariant geometry and Calabi Yau manifolds
Western Algebraic Geometry Symposium, UBC (April)
Equivariant geometry and Calabi Yau manifolds
Institute for Advanced Study, Princeton (March)
Equivariant geometry and Calabi Yau manifolds
University of Oregon (March)

Equivariant geometry and Calabi Yau manifolds

Cornell University (February)

Equivariant geometry and Calabi Yau manifolds

University of Waterloo (February)

Equivariant geometry and Calabi Yau manifolds

University of Toronto (January)

Equivariant geometry and Calabi Yau manifolds

Northwestern University (January)

Equivariant geometry and Calabi Yau manifolds

University of California, Berkeley (January)

Equivariant geometry and Calabi Yau manifolds

Non-abelian localization and the Verlinde formula

Duke University (January)

Equivariant geometry and Calabi Yau manifolds

Yale (November)

Equivariant geometry and Calabi Yau manifolds

2016

UC San Diego (December)

Equivariant geometry and Calabi Yau manifolds

Yale (November)

Equivariant geometry and Calabi Yau manifolds

Northwestern University (October)

(Lecture 1) Equivariant hodge theory and noncommutative geometry

(Lecture 2) Equivariant Morse theory in algebraic geometry

University of California, Los Angeles (October)

(Lecture 1, colloquium) Equivariant Morse theory in algebraic geometry

(Lecture 2, algebra seminar) The equivariant verlinde formula on the moduli of Higgs bundles

University of Virginia (algebra seminar, September)

Magic windows and representations of generalized braid groups on the derived category of a GIT quotient

Simons Center (conference, September)

Derived equivalences between moduli spaces of coherent sheaves on a K3 surface

ICTP Trieste (conference, August)

Magic windows and representations of generalized braid groups on the derived category of a GIT quotient

Banff International Research Station (Homological mirror geometry conference, March)

Magic windows and representations of generalized braid groups on the derived category of a GIT quotient

2015

University of Oxford (seminar, December)

(Lecture 1) The structure of instability in moduli theory

(Lecture 2) Applications of Theta-stratifications

UNC Chapel Hill (workshop on new developments in moduli and geometric invariant theory, November)

Applications of Theta-stratifications

Northeastern University (algebraic geometry seminar, November)
Tannaka duality and the unreasonable effectiveness of linear algebra.

Cornell University (topology seminar, October)
Equivariant topology and non-commutative geometry

Massachusetts Institute of Technology (algebraic geometry seminar, September)
Equivariant Hodge theory

AMS Summer institute in algebraic geometry (conference, July)
Theta-reductive moduli problems, stratifications, and applications

University of Warwick (workshop on derived categories and birational geometry, June)
Equivariant Hodge theory

University of Edinburgh (EDGE seminar, May)
Equivariant Hodge theory

Rutgers-Newark (colloquium, April)
Beyond geometric invariant theory

Mathematisches Forschungsinstitut Oberwolfach (algebraic geometry conference, March)
Theta-reductive moduli problems, stratifications, and applications

Stony Brook University (algebraic geometry seminar, March)
Reductive moduli problems, stratifications, and applications

Harvard University (gauge theory, topology, and symplectic geometry seminar, Feb)
Morse-like stratifications of moduli problems in algebraic geometry

Rutgers University (geometry, symmetry, and physics seminar, Feb)
Equivariant noncommutative Hodge theory

University of Chicago (algebraic geometry seminar, Feb)
Reductive moduli problems, stratifications, and applications

UIUC (algebraic geometry seminar, Feb)
Reductive moduli problems, stratifications, and applications

2014

Rice University (algebraic geometry seminar, Nov)
Instability in moduli theory

Cal Tech (algebraic geometry seminar, Oct)
The structure of instability in moduli theory

KIAS (ICM satellite conference: Geometry and Physics of Gauged Linear Sigma Model, July)
The structure of instability in moduli theory

University of Pennsylvania (Math-physics joint seminar, April)
Instability in Moduli Theory

UBC (PIMS geometry and physics seminar, Feb)
Instability in algebraic geometry

UIUC (algebraic geometry seminar, Feb)
Mapping stacks and the notion of properness in algebraic geometry

2013

Rutgers University (geometry, symmetry, and physics seminar, Oct)
Instability in algebraic geometry

Columbia University (algebraic geometry seminar, Oct)

Instability in algebraic geometry

University of Michigan (conference, Geometry and Physics of Gauged Linear Sigma Model, March)

Stratifications of algebraic stacks and derived categories

2012

Institute for the Physics and Mathematics of the Universe (conference, Homological Projective Duality and Quantum Gauge Theory, march)

Fractional grade restriction rules and autoequivalences of derived categories

UC Berkeley (workshop, Tensors and their Geometry in High Dimensions, Sept)

Geometric invariant theory and derived categories

University of Vienna (workshop, Birational Geometry and Derived Categories, Aug)

Derived Kirwan surjectivity and autoequivalences of derived categories

University of Warwick (conference, School on Algebraic Geometry and Theoretical Physics, July)

Localization and the derived category of a GIT quotient

Institute for the Physics and Mathematics of the Universe (DMM seminar, June)

The derived category of a GIT quotient

UC Berkeley (RTGC seminar, March)

The derived category of a GIT quotient

2011

University of Georgia (Southeastern Section Meeting of the AMS)

The Lefschetz Hyperplane Theorem for stacks.

Service and other activities:

- Member for the A-exams at Cornell: David Mehrle, Hannah Keese, Brandon Shapiro, Andres Fernandez Herrero, Elise McMahon
- Co-organized the Lie groups and algebraic geometry seminar, Cornell 2017-2019
- Served on Putnam committee, placement exam committee, and graduate admissions committee, Cornell 2017-2019
- Served as departmental representative (official faculty contact and organizer) for Columbia Summer Session in Mathematics, Summer 2016.
- Experimented with news ways of communicating mathematical ideas: created HTML/Java code to produce interactive concept maps which can be used to illustrate the key concepts, theorems, and papers in a subject and how they are related
- Served as a mentor for younger graduate students in the geometry group through the Math Graduate Student Association at UC Berkeley, 2010-2013
- Organized graduate seminars at UC Berkeley: Moduli spaces in algebraic geometry (Spring 2013), Gromov-Witten Theory (Spring 2010), Weekly student Lunch Seminar (2010-2013)