Michael McBreen

Center of Mathematical Sciences and Applications
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Research Focus

I study the intersection of representation theory, symplectic geometry and mathematical physics, focusing on conformal field theory, supersymmetric gauge theory and topological string theory. Much of my work is concerned with the phenomena of mirror symmetry and langlands duality for symplectic resolutions, a class of algebraic symplectic spaces which have become key players in modern representation theory.

Current Employment

Harvard Center Of Mathematical Sciences And Applications
Postdoctoral Researcher, 2019-Present.

Aarhus University
Postdoctoral Fellow, 2019-Present.

Past Employment

University of Toronto
Postdoctoral Fellow, 2018-2019.

Massachusetts Institute of Technology
C.L.E. Moore Instructor, 2015-2017.

École Polytechnique Fédérale de Lausanne
Postdoctoral Fellow, 2014-2015.

Massachusetts Institute of Technology
Postdoctoral Associate, 2013-2014.

Education

Princeton University
Ph.D., 2008-2013.

McGill University
B.S. Mathematics with minor in Physics, 2005-2008.

Preprints

Hypertoric Hitchin systems and Kirchhoff polynomials
(with Michael Groechenig) arXiv:2001.11084 (2020).

Deletion-Contraction Triangles for Hausel-Proudfoot Varieties
(with Zsuzsana Dancso and Vivek Shende) arXiv:1910.00979 (2019).

Homological Mirror Symmetry for Hypertoric Varieties II
(with Ben Gammage and Ben Webster) arXiv:1903.07928 (2019).

The Quantum Hikita Conjecture
(with Joel Kamnitzer and Nick Proudfoot) arXiv:1807.09858 (2018).

Homological Mirror Symmetry for Hypertoric Varieties I
(with Ben Webster) arXiv:1804.10646 (2018).

Publications

Intersection Cohomology and Quantum Cohomology of Conical Symplectic Resolutions
(with Nick Proudfoot) Algebraic Geometry 2 (2015), no. 5, 623–641.

Quantum Cohomology of Hypertoric varieties
(with Daniel Shenfeld) Letters in Mathematical Physics 103 (2013), no. 11, 1273–1291.

Excited States of $U(1)_{2+1}$ Lattice Gauge Theory from Monte Carlo Hamiltonian
(with Ahmad Hosseinizadeh, Gurgen Melkonyan, Helmut Kroeger, and N. Scheu) Modern Physics Letters A 26 (2011) no. 29, 2169–2191.

Thesis

Quantum Cohomology of Hypertoric Varieties and Geometric Representations of Yangians.
Doctoral thesis under the direction of Andrei Okounkov, Princeton University (2013).

Teaching

University of Toronto

Lecturer for Groups and Symmetries (MAT301), Spring semester, 2019.

Lecturer for Introduction to Combinatorics (MAT344), Fall semester, 2018.

Lecturer for Linear Algebra (MAT185), Spring semester, 2018.

Massachusetts Institute of Technology

Co-Lecturer for Topics in Algebra (18.708), Spring Semester, 2017.

Lecturer for Calculus with Theory (18.024), Spring Semester, 2017.

Lecturer for Calculus with Theory (18.014), Fall Semester, 2016.

Teaching Assistant and Course Administrator for Differential Equations (18.03), Spring Semester, 2016.

Teaching Assistant for Calculus II (18.02), Fall Semester, 2015.

Teaching Assistant for Advanced Differential Equations (18.034), Spring Semester, 2014.

Teaching Assistant for Differential Equations (18.03), Fall semester, 2013.

École Polytechnique Fédérale de Lausanne

Teaching assistant for Analysis I, Fall semester, 2014.

Columbia University

Lecurer for Calculus II, Fall semester, 2012.

Service

Co-organized the University of Toronto geometric representation theory seminar, 2018-2019.

Member of the thesis defense committee of Dorin Boger, Massachussetts Institute of Technology, April 2016.

Organized the mirror symmetry retreat for graduate students, Princeton University, 2011.

Co-Founded The Delta-Epsilon, or McGill Undergraduate Mathematics Journal, 2006-2007.

Conference and Workshop Talks

Representation theory, gauge theory and integrable systems
Kavli IPMU, February 2019.

AMS-CMS joint international meeting
Fudan University, May 2018.

A_∞ structures in geometry and representation theory workshop
Hausdorff Institute, November 2018.

Geometric representation theory
University of Glasgow, June 2017.

Categorifications, derived geometry and quantum cohomology
Université Paris 7, January 2017.

Geometric representation theory
Simons Center for Geometry and Physics, January 2016.

Geometry of moduli spaces and representation theory
IAS/Park City Institute, July 2015.

Symplectic representation theory
University of Glasgow, November 2015.

Symplectic representation theory
University of Glasgow, November 2015.

Quantization of moduli spaces
University of Geneva, April 2014.

Mirror symmetry week
Hebrew University, June 2014.

Seminar Talks

Northeastern University, February 2020.

University of Toronto, January 2020

Aarhus University, October 2019.

Perimeter Institute, September 2019.

UC Berkeley, September 2019.

Cornell University, March 2019.

Ohio State University, March 2019.

University of Toronto, January 2018.

Columbia University, December 2018.

Massachusetts Institute of Technology, November 2018.

Tsinghua University, May 2018.

University of Toronto, January 2018.

Hausdorff Institute, October 2018.

Massachusetts Institute of Technology, February 2017.

Perimeter Institute, May 2016.

University of Toronto, March 2016.

Columbia University, January 2016.

Caltech, November 2015.

UC Riverside, November 2015.

Higher School of Economics, Moscow, June 2015.

University of Edinburgh, March 2015.

Max Plank Institute, Bonn, March 2014.

Université Paris-Sud 11, November 2014

Tel-Aviv University, June 2014.

Simons Center for Geometry and Physics, May 2014.

Boston University, February 2014.

Northeastern University, October 2013.

Columbia University, October 2013.

Massachusetts Institute of Technology, April 2013.

University of Oregon, May 2013.

University of Toronto, January 2013.

Rutgers University, Febuary 2013.

Massachusetts Institute of Technology, November 2012.

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