

# DAVID L. DUNCAN

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## Employment

- **Postdoctoral Fellow**—McMaster University  
*September 2015 - Present*
- **Visiting Assistant Professor**—Michigan State University  
*August 2013 - August 2015*

## Education

- **Ph.D. Mathematics**—Rutgers University  
*Degree Received: May 2013*
  - Advisor: Chris Woodward
  - Dissertation Title: *Compactness Results for the Quilted Atiyah-Floer Conjecture*
- **B.S. Mathematics**—University of Washington  
*Degree Received: August 2006*
  - Distinction in Mathematics
  - Comprehensive Option
  - Minor in Physics

## Research Interests

- Gauge Theory
- Low-Dimensional Topology
- Symplectic Geometry

## Publications

- D. Duncan. The Chern-Simons invariants for doubles of compression bodies. *Pac. J. Math.* **280**, 17-39, 2016.
- D. Duncan. Compactness results for neck stretching limits of instantons. 63 pages.
- D. Duncan. The Yang-Mills flow on cylindrical end manifolds. (Submitted), 53 pages, 2016.
- D. Duncan. An index relation for the quilted Atiyah-Floer conjecture. (Revise and Resubmit), 33 pages. arXiv:1311.4004.

## Selected Research Talks

- "Gauge theory: Using PDEs to study manifolds". University of Nebraska, Omaha Colloquium, NE. February 2018.
- "Triangles and princesses and bears. Oh my!". University of Nebraska, Omaha Student Engagement Talk, NE. February 2018.
- "Triangles and princesses and bears. Oh my!". Hillsdale College Colloquium, MI. February 2018.
- "Gauge theory: Using PDEs to study manifolds". James Madison University Colloquium, VA. January 2018.
- "A short tour from manifolds to gauge theory (and back?)". McMaster Threads Colloquium, ON. January 2018.
- "Some open problems in gauge theory, symplectic geometry, and low-dimensional topology". McMaster Geometry & Topology Seminar, ON. November 2017.
- "Boundary-singular holomorphic curves from instantons". Fields Institute Thematic Program on Geometric Analysis - Postdoctoral Seminar, ON. September 2017.
- "From instantons to holomorphic curves". Simons Center Workshop on Gauge Theory and Low Dimensional Topology, NY. April 2017.
- "Identifying instantons with holomorphic curves". Waterloo Geometry & Topology Seminar, ON. March 2017.
- "Triangles and princesses and bears. Oh my!". Hamilton College Mathematics Colloquium, NY. January 2017.
- "Heat flows for cylindrical end manifolds". CMS Winter Meeting in Niagara, ON. December 2016.
- "A new proof of a theorem of Dostoglou and Salamon". BIRS Conference on Interactions of Gauge Theory with Contact and Symplectic Topology in Dimensions 3 and 4 in Banff, AB. April 2016.
- "A new proof of a theorem of Dostoglou and Salamon". Rutgers Geometry, Physics, and Mirror Symmetry Seminar in Piscataway, NJ. March 2016.
- "The quilted Atiyah-Floer conjecture and the Yang-Mills heat flow". SIAM Conference on Analysis in Partial Differential Equations in Scottsdale, AZ. December 2015.
- "Gauge theoretic invariants of surface products". CMS Winter Meeting in Montréal, QC. December 2015.
- "Instanton and symplectic invariants for surface products". Fields geometric structures laboratory in Toronto, ON. October 2015.
- "The quilted Atiyah-Floer conjecture and the Yang-Mills heat flow". AMS Spring Meeting in Washington DC. March 2015.
- "From instantons to quilts with boundary degenerations". CMS Winter Meeting in Hamilton, ON. December 2014.
- "Instanton Floer homology and symplectic geometry". Rutgers Geometry Seminar. April 2014.

- "Yang-Mills connections for degenerating metrics". McMaster Geometry and Topology Seminar. April 2014.
- "On the critical values of the Chern-Simons functional". Purdue Geometry Seminar. March 2014.
- "A compactness result for the quilted Atiyah-Floer conjecture". McMaster Geometry and Topology Seminar. February 2013.
- "A compactness result for the quilted Atiyah-Floer conjecture". University of Toronto Symplectic Geometry Seminar. January 2013.

## Selected Teaching Talks

- "Connecting learning goals and exams in STEM classes". Rutgers TA Project Graduate Student Workshop. February 2013.
- "Assessment—How to tell if students have learned what you want them to learn and giving feedback on assignments". Rutgers College Teaching II. November 2012, November 2011.
- Invited Panelist. Rutgers TA Training for Graduate Students in Mathematics. March 2012.
- "Dealing with different levels of academic preparation". Rutgers TA Project Graduate Student Workshop. October 2012.
- "Understanding your undergraduates: your students and their world". Rutgers TA Project Graduate Student Workshop. February 2012, September 2010.
- "Helping struggling students". Rutgers TA Project Graduate Student Workshop. October 2011.
- "Creative teaching in the STEM disciplines". Rutgers TA Project Graduate Student Workshop. April 2011.
- Invited Speaker. Rutgers TA Training for Graduate Students in Mathematics. March 2011.
- Invited Panelist. Rutgers TA Project Teaching Assistant Orientation. August 2010.
- Invited Panelist. Rutgers Innovation Through Institutional Integration Mentoring Skills Workshop. May 2010.

## Fellowships, Awards, etc.

- McMaster University Britton Postdoctoral Fellowship. Fall 2015-Spring 2017.
- Michigan State University RTG Grant. Spring 2014. NSF Award Number DMS 0739208.
- Research Assistantship. Rutgers University. Fall 2010, Fall 2011, Fall 2012.
- Rutgers Academy for the Scholarship of Teaching and Learning (RASTL) Fellowship. 2010 - 2011, 2011 - 2012, 2012 - 2013.
- TA Excellence Award. Spring 2010.
- Graduate Assistance in Areas of National Need (GAANN) Fellowship. 2007 - 2008.

## Conferences and Seminars Organized

- *Geometry and Topology Seminar*. McMaster University. Organizer. Winter 2017, Fall 2016.
- *Fields Gauge Theory Seminar*. Fields Institute. Organizer (with I. Hambleton). Fall 2015.
- *Special Session on Floer Homology, Gauge Theory, and Symplectic Geometry*. AMS Spring Meeting in East Lansing. Organizer (with M. Hedden and T. Parker). March 2015.
- *Graduate Student Geometry Seminar*. Rutgers University. Organizer (with A. Maalaoui). 2010-2012

## Teaching Experience

- **Graduate Teaching—McMaster University**
  - Math 762: Differential Geometry. Winter 2017.
- **Undergraduate Teaching—McMaster University**
  - Math 4W03: Reading in Mathematics. Winter 2018.
  - Math 3T03: Topology. Winter 2018.
  - Math 3A03: Analysis. Fall 2017.
  - Math 1C03: Introduction to Mathematical Reasoning. Fall 2016.
  - Math 3T03: Topology. Spring 2016.
  - Math 1A03: Calculus I. Fall 2015.
- **Undergraduate Teaching—Michigan State University**
  - Math 330: Higher Geometry. Summer 2015.
  - Math 396: Capstone in Mathematics for Secondary Education. Spring 2015.
  - Math 153H: Calculus II (Honors). Fall 2014.
  - Math 299: Transitions to Formal Mathematics. Fall 2014.
  - Math 299: Transitions to Formal Mathematics. Spring 2014.
  - Math 299: Transitions to Formal Mathematics. Fall 2013 (two sections).
- **Undergraduate Teaching—Rutgers University**
  - Head Teaching Assistant. Summer 2012, Summer 2011.
  - Math 152: Calculus II for Mathematical and Physical Sciences. Lecturer and Workshop Instructor. Spring 2012, Spring 2010.
  - Math 421: Advanced Calculus for Engineering. Lecturer. Summer 2011.
  - Math 151: Calculus I for Mathematical and Physical Sciences. Lecturer and Workshop Instructor. Spring 2011, Fall 2009.
  - Math 151: Calculus I for Mathematical and Physical Sciences. Workshop Instructor. Spring 2009.
  - Math 135: Calculus I. Recitation Instructor. Fall 2008.
- **K-12 Teaching—Kelsey Creek Alternative School**
  - Geometry. Instructor. Spring 2004, 2004 - 2005, 2005 - 2006, Fall 2006.
  - Physics. Instructor. Fall 2006.
  - Math Enrichment. Instructor. Fall 2006.
  - Science Enrichment. Instructor. Fall 2006.
  - Logic. Instructor. 2005 - 2006.
  - Math Analysis. Instructor. 2005 - 2006.
  - Calculus. Instructor. 2004-2005.
- **K-12 Teaching (Supplemental Learning)—Prime Learning Center**

- Geometry I A. Instructor. 3 sessions. 2005 - 2006.
- Geometry I B. Instructor. 2 sessions. 2005 - 2006.
- Pre-Algebra I A. Instructor. 1 session. 2006.
- Algebra I A. Instructor. 1 session. 2005.

## Mentoring Experience

- **REU (Research Experience for Undergraduate)—Rutgers University**
  - Mentor (with C. Woodward). Project: Injectivity of the Narasimhan-Seshadri map for instantons. Summer 2014. Supported by NSF Award DMS 1207194.
  - Mentor (with C. Woodward). Project: Heegaard Splittings of Circle Fibrations. Summer 2012. Supported by NSF Award DMS 0605097.
  - Assistant Mentor (with C. Woodward). Project: Displacing Fibers of Moment Polytopes. Summer 2010.
- **Reading Course—Michigan State University**
  - Graduate Mentor. Project: Introduction to Morse 2-Functions. Spring 2014.
- **Directed Reading Program—Rutgers University**
  - Undergraduate Mentor. Project: Linear Operators on Function Spaces. Summer 2011.
  - Undergraduate Mentor. Project: Complex Vector Spaces. Spring 2011.
  - Undergraduate Mentor. Project: Projective Space. Summer 2010.
  - Undergraduate Mentor. Project: The Riemann Zeta Function. Fall 2008.
  - Undergraduate Mentor. Project: Matrix Lie Groups. Fall 2007.
- **DIMACS REU (Research Experience for Undergraduates)—Charles University in Prague, Czech Republic**
  - Prague Group Mentor. Summer 2009, Summer 2010.

## Service

- **Referee**
  - Geometriae Dedicata
  - SIGMA

## Other Activities

- **Fields Institute—Toronto, ON**
  - Teaching Assistant (for A. Naber). Summer School on Geometric Analysis. Summer 2017.
- **Michigan State University, Department of Mathematics—East Lansing, MI**

- Coordinator (with K. Stilson and B. Dillman). Math Summer Camp (Grades 4-6). Summer 2015.

- **DIMACS—Piscataway, NJ**

- Graduate Coordinator (with B. Nakamura). DIMACS/Rutgers Math REU (Research Experience for Undergraduates). Summer 2009, Summer 2010.

- **Math Club at UW—Seattle, WA**

- Member. 2005-2006.
- President and Cofounder. 2005.

- **Education Access Network—Seattle, WA**

- Mathematics Curriculum Developer. Spring 2006 - Fall 2006.
- SAT/ACT Math Preparation Workshop. Instructor. Spring 2006 - Summer 2006.

## Undergraduate Research

- **Besicovitch's Approach to Kakeya's Conjecture—Senior Thesis**

- Advisor: Jim Morrow

- **Stochastic Loewner Evolution**

- Advisors: Steffen Rohde, Joan Lind