

# CURRICULUM VITAE

## JORDAN ALAN WATTS

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### ADDRESS

Department of Mathematics  
University of Colorado Boulder  
Campus Box 395  
Boulder, Colorado 80309-0395  
United States of America

Phone: (303) 492-4354  
Email: jordan.watts@colorado.edu  
Web: euclid.colorado.edu/~jowa8403

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### PERSONAL DETAILS

Citizenship: Canadian (Permanent Resident of USA)      Languages: English

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### RESEARCH INTERESTS

topological methods in data analysis, differential topology, generalisations of smooth structures (Sikorski differential spaces, subcartesian spaces, diffeology, Lie groupoids, stacks), Lie group actions, symplectic geometry, Hamiltonian group actions, orbifolds

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### APPOINTMENTS

Fall, 2017      **University of Colorado Boulder** (Boulder, CO, USA)  
— Lecturer

2015-2017      **University of Colorado Boulder** (Boulder, CO, USA)  
— Burnett Meyer Postdoc

2012-2015      **University of Illinois at Urbana-Champaign** (Champaign-Urbana, IL, USA)  
— J. J. Uhl Research Assistant Professor

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### EDUCATION

2012      **University of Toronto** (Toronto, ON, Canada)  
**PhD in Mathematics**  
— Supervisor: Yael Karshon (University of Toronto)

2007      **University of Toronto** (Toronto, ON, Canada)  
**MSc in Mathematics** (Course-based)  
— Mentor: Yael Karshon (University of Toronto)

2006      **University of Calgary** (Calgary, AB, Canada)  
**MSc in Applied Mathematics** (Thesis-based)  
— Supervisor: Jędrzej Śniatycki (University of Calgary)

2004      **University of Calgary** (Calgary, AB, Canada)  
**BSc in Pure & Applied Mathematics** (Double Major)

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## PAPERS AND PUBLICATIONS

My Erdős number is 4!

Jordan Watts  $\rightsquigarrow$  Yael Karshon  $\rightsquigarrow$  Shlomo Sternberg  $\rightsquigarrow$  Fan Chung  $\rightsquigarrow$  Paul Erdős

### Published:

Susan Tolman and Jordan Watts, “Tame circle actions”, *Trans. Amer. Math. Soc.* **369** (2017), 7443–7467.

<http://www.ams.org/journals/tran/0000-000-00/S0002-9947-2017-07113-0/>)

Yael Karshon and Jordan Watts, “Basic forms and orbit spaces: a diffeological approach”, *SIGMA Symmetry Integrability Geom. Methods Appl.* **12** (2016), 026, 19 pages

<http://www.emis.de/journals/SIGMA/2016/026/sigma16-026.pdf>

Jordan Watts, “The differential structure of an orbifold”, *Rocky Mountain J. Math.*, **47** (2017), 289–327.

Jiayong Li and Jordan Alan Watts, “The orientation-preserving diffeomorphism group of  $S^2$  deforms to  $SO(3)$  smoothly”, *Transformation Groups* **16** (2011), Spring, 537–553.

Tsasa Lusala, Jędrzej Sniatycki, and Jordan Alan Watts, “Regular Points of a Subcartesian Space”, *Canad. Math. Bull.* **53** (2010), 340–346.

### Submitted for Publication:

Derek Krepski and Jordan Watts, “Differential cocycles and Dixmier-Douady bundles”, 23 pages.

Suzanne Craig, Naiche Downey, Lucas Goad, Michael Maloney, Jordan Watts, “Orbit Spaces of Linear Circle Actions”, 15 pages.

Jordan Watts, “Symplectic quotients and representability: the circle action case”, 19 pages.

Jean-Pierre Magnot and Jordan Watts, “The diffeology of Milnor’s classifying space”, 28 pages.

Jordan Watts and Seth Wolbert, “The diffeological coarse moduli space of a stack”, 15 pages.

### Preprints:

Jordan Watts, “The orbit space and basic forms of proper Lie groupoids”.

Augustin Batubenge, Patrick Iglesias-Zemmour, Yael Karshon, and Jordan Watts, “Diffeological, Frölicher, and differential spaces” .

### Theses:

Jordan Alan Watts, *Diffeologies, Differential Spaces, and Symplectic Geometry*, PhD Thesis, Department of Mathematics, University of Toronto, 108 pages, 2012.

Jordan Alan Watts, *The Calculus on Subcartesian Spaces*, MSc Thesis, Department of Mathematics, University of Calgary, 116 pages, 2006.

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## TEACHING EXPERIENCE

I will be teaching MATH 6240 (Differential Geometry II - **graduate level**), and two sections of MATH 3001 (Real Analysis I) in Fall 2017, University of Colorado Boulder.

Courses taught:

1. MATH 6230 (differential geometry - **graduate level**) Spring 2017, University of Colorado Boulder
2. MATH 3001 (real analysis) Fall 2016, University of Colorado Boulder
3. MATH 2400 (multivariable calculus) Spring 2016, University of Colorado Boulder
4. MATH 3430 (ordinary differential equations) Fall 2015, University of Colorado Boulder
5. MATH 2300 (single variable calculus (2nd course) - honors section) Fall 2015, University of Colorado Boulder
6. MATH 535 (general topology - **graduate level**) Fall 2013 and Fall 2014, University of Illinois
7. MATH 415 (applied linear algebra with *Mathematica*) Fall 2012 and Spring 2013, University of Illinois
8. MATH 241 (multivariable calculus with *Mathematica*) Spring 2013 and Spring 2014, University of Illinois
9. MATH 221 (single variable calculus - **large lecture** with 250+ students), Fall 2014, University of Illinois
10. MAT235 (multivariable calculus) Summer 2011 and 2012, University of Toronto
11. MAT137 (advanced single variable calculus) Fall/Winter 2011-12, University of Toronto Mississauga Campus
12. MAT237 (advanced multivariable calculus) Summer 2010, University of Toronto

In Summer 2016, I headed an REU project with three undergraduate students and one graduate student, entitled “Invariants of Quotients by Circle Actions”. The goal of this project is to see how well smooth functions on a semi-algebraic variety that locally is the quotient of a manifold by a circle action can tell which circle action were used to construct it. If there is any missing information required, what is it, and how can it be incorporated? This project is an attempt to push the results of my paper “The differential structure of an orbifold” to more general orbit spaces. A paper to be published is currently in the works.

In Spring 2015, I was the faculty mentor for an Illinois Geometry Lab project “Evolution of Curves and Surfaces”, in which three undergraduate students work together under the mentorship of a graduate student and myself on a project that I develop. This particular project used some programming in *Mathematica* to model the “evolution” of randomly perturbed objects with a certain bias: for example, simple closed curves changing randomly with a bias toward encompassing the most area tend to converge toward a circle. One of the students made a website for the project: <http://yhuan124.wix.com/iglevolution>.

I took a course in 2010 at the University of Toronto, “Teaching Large Classes”, run by Prof. Joe Repka, Department of Mathematics, University of Toronto. This course helps prepare the student for organising a course, and also gives the student an opportunity to teach a lecture or two of first year undergraduate mathematics.

I have been a teaching assistant in mathematics regularly from 2003-2011, with experience TA'ing the subjects of calculus, linear algebra, discrete mathematics, abstract algebra, differential equations, Riemannian geometry, complex analysis, and Galois theory.

I was a mentor in the University of Toronto Faculty of Arts and Sciences Mentorship Programme during the 2008-2009 school year. This involved having biweekly meetings with two high school students, and teaching them various aspects of mathematics.

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## LANGUAGES

I am either fluent in or have substantial experience with SQL, PHP, HTML, CSS, *Mathematica*, and LaTeX. I am currently learning Python (especially geared toward data analysis) and C++.

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## AWARDS AND GRANTS

Co-PI for NSF Grant DMS 1543812 for the Gone Fishing 2016 Conference

Travel Grants (CU Boulder, 2015-2017)

Travel Grants (UIUC, 2012-2015)

Queen Elizabeth II Scholarship (2011)

Ontario Graduate Scholarship (2010)

Graduate Student Scholarship (Government of Alberta, 2005)

Province of Alberta Graduate Scholarship (2005)

Received Undergraduate NSERC grant for the summer of 2004, working with Jędrzej Śniatycki of the University of Calgary, studying “subcartesian spaces”.

Student Achievement Scholarship (3 consecutive years, 1999-2002)

Governor General’s Academic Bronze Medal (1999)

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## SELECTED LECTURES & TALKS

I have given (or will give) the following lectures and talks:

*Groupoidfest 2017*

University of Colorado Boulder, Boulder, Colorado, USA; March 2017 “Symplectic Quotients by Circle Actions are not Representable”

*Colloquium*

Queen’s University, Kingston, Ontario, Canada;  
March 2017 “Quotients of Lie Group Actions” **invited**

*Colloquium*

University of Denver, Denver, Colorado, USA;  
March 2017 “Lie Group Actions and Differentiability Beyond Manifolds” **invited**

*Topology (Learning) Seminar*

University of Colorado Boulder, Boulder, Colorado, USA;  
February 2017 “Vector Bundles and the Thom Isomorphism Theorem”

*Algebra and Logic Seminar*

University of Denver, Denver, Colorado, USA;  
January 2017 “Quotients of Lie Group Actions” **invited**

*Topology (Learning) Seminar*

University of Colorado Boulder, Boulder, Colorado, USA;  
November 2016 “Stratified Spaces and Intersection Homology” (series of two lectures)

*Geometry, Groups, and Dynamics/GEAR Seminar*

University of Illinois at Urbana-Champaign, Urbana, Illinois, USA;  
September 2016 “Colimits as Limits and Limits as Colimits ... with Applications!”

*Geometry, Topology, and Dynamics Seminar*

University of Illinois at Chicago, Chicago, Illinois, USA;

September 2016 “Colimits as Limits and Limits as Colimits ... with Applications!” **(invited)**

*AMS Sectional Spring Central Meeting*

North Dakota State University, Fargo, North Dakota, USA;

April 2016 “Tame Circle Actions” **(invited)**

*Stratifications, Differentiable Spaces, and Poisson Geometry Seminar*

University of Colorado Boulder, Boulder, Colorado, USA;

March 2016 “Tame Circle Actions”

*CMS Winter Meeting 2015*

Montreal, Quebec, Canada;

December 2015 “Tame Circle Actions”

*Stratifications, Differentiable Spaces, and Poisson Geometry Seminar*

University of Colorado at Boulder, Boulder, Colorado, USA;

November 2015 “Symplectic and Poisson Reduction” (series of three lectures)

*Groupoidfest 2015*

University of Memphis, Memphis, Tennessee, USA;

October 2015 “The differential structure of an orbifold” **(invited)**

*Colloquium*

Dalhousie University, Halifax, Nova Scotia, Canada;

June 2015 “The differential structure of an orbifold” **(invited)**

*Symplectic & Poisson Geometry Seminar*

University of Illinois at Urbana-Champaign, Urbana, Illinois, USA;

May 2015 “The differential structure of an orbifold”

*Kempner Colloquium*

University of Colorado - Boulder, Boulder, Colorado, USA;

March 2015 “The differential structure of an orbifold” **(invited)**

*Colloquium*

University of Manitoba, Winnipeg, Manitoba, Canada;

January 2015 “So what is an orbifold, anyway?” **(invited)**

*AMS Joint Mathematics Meetings 2015*

San Antonio, Texas, USA;

January 2015 “Calculus on Reduced Spaces” **(invited)**

*New Geometries for Physics: Workshop on Diffeology*

Aix en Provence, France;

June 2014 “Basic Differential Forms on a Proper Lie Groupoid” **(invited)**

*2014 CMS Summer Meeting*

Winnipeg, Manitoba, Canada;

June 2014 “Coarse Moduli Spaces of Stacks over Manifolds” **(invited)**

*UIUC-WUSTL Symplectic Geometry Seminar 2014*

Washington University, St. Louis, Missouri, USA;

April 2014 “Coarse Moduli Spaces of Stacks over Manifolds” **(invited)**

*Topology Seminar*

University of Illinois at Urbana-Champaign, Urbana, Illinois, USA;

February, 2014 “Coarse Moduli Spaces of Stacks over Manifolds”

*AMS Joint Mathematics Meetings 2014*

Baltimore, Maryland, USA;

January 2014 “Basic Differential Forms on Geometric Stacks”

*Gone Fishing*

Temple University, Philadelphia, Pennsylvania, USA;  
September 2013 “Koszul’s Theorem on Differential Forms for Proper Lie Groupoids” **(invited)**

*Symplectic & Poisson Geometry Seminar*

University of Illinois at Urbana-Champaign, Urbana, Illinois, USA;  
August 2013 “de Rham complexes on orbit spaces and symplectic quotients”

*Geometry & Topology Seminar*

McMaster University, Hamilton, Ontario, Canada;  
March 2012 “Differential Forms on Symplectic Quotients” **(invited)**

*Geometry & Topology Seminar*

University of Western Ontario, London, Ontario, Canada;  
March 2012 “Differential Forms on Symplectic Quotients” **(invited)**

*Geometry & Topology Seminar*

University of Waterloo, Waterloo, Ontario, Canada;  
February 2012 “Differential Forms on Symplectic Quotients” **(invited)**

*Quantum Cohomology Group*

University of Toronto, Toronto, Ontario, Canada;  
February 2012 “Stable Maps”

*Calabi Conjecture Reading Group*

University of Toronto, Toronto, Ontario, Canada;  
June 2010 “Holonomy”

*Hamiltonian Group Actions* (course)

University of Toronto, Toronto, Ontario, Canada;  
April 2010 “Cohomologically Free Symplectic Group Actions”

*CoolStuff Student Seminar*

University of Toronto, Toronto, Ontario, Canada;  
July 2009 “Diffeomorphisms of the 2-Sphere”

*CoolStuff Student Seminar*

University of Toronto, Toronto, Ontario, Canada;  
July 2009 “Gromov’s Nonsqueezing Theorem”

*Quantum Field Theory Student Seminar*

University of Toronto, Toronto, Ontario, Canada;  
July 2008 “Clifford Algebras and the Spin Group”

*CoolStuff Student Seminar*

University of Toronto, Toronto, Ontario, Canada;  
Summer 2008 “Cobordisms & Homotopy Groups: Pontrjagin’s Construction”

*Riemannian Geometry Reading Group*

University of Toronto, Toronto, Ontario, Canada;  
June 2008 “Introduction to Riemannian Metrics”

*CoolStuff Student Seminar*

University of Toronto, Toronto, Ontario, Canada;  
Summer 2007 “Subcartesian Spaces”

*Symplectic Geometry* (course)

University of Toronto, Toronto, Ontario, Canada;  
April 2007 “Poisson Manifolds”

*Applied Math Seminar*

University of Calgary, Calgary, Alberta, Canada;  
Winter 2005 “Theta Functions & Elliptic Trigonometry”

*Applied Math Seminar*  
University of Calgary, Calgary, Alberta, Canada;  
Fall 2005, Fall 2006 “Subcartesian Spaces”

*Alberta Young Researchers Conference*  
University of Calgary, Calgary, Alberta, Canada;  
April 2005 “Subcartesian Spaces”

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## OTHER WORK EXPERIENCE AND CONTRIBUTIONS

I am one of the **organisers** of the Topology Seminar at the University of Colorado Boulder in the 2016-2017 year.

I am a guest **editor** for the special issue “Gone Fishing” of the journal SIGMA: <http://www.emis.de/journals/SIGMA/gone-fishing2016.html>.

I was one of the **organisers** of the Gone Fishing 2016 workshop at the University of Colorado Boulder in March 2016.

I was one of the **organisers** of the Stratifications, Differentiable Structures, and Poisson Geometry Seminar at the University of Colorado - Boulder in the 2015-2016 year.

I was one of the **organisers** of the Poisson 2014 conference at the University of Illinois at Urbana-Champaign in Summer 2014.

I was the **organiser** of the Symplectic and Poisson Geometry Seminar at the University of Illinois at Urbana-Champaign for the 2013-2014 and 2014-2015 years.

I have refereed various mathematical papers for journals in mathematics, as well as textbooks for undergraduate courses.

I have served (or am serving) on defence committees and preliminary oral exam committees for PhD candidates studying symplectic geometry, contact geometry, and differential geometry.

I organised the Quantum Cohomology Group in Winter 2012. This reading seminar went through the book *Invitation to Quantum Cohomology* by J. Kock and I. Vainsencher.

Member of the Math Graduate Student Association at the University of Toronto; in particular, part of the Graduate Planning Committee for three years (2008-2011).

I organised a team of math graduate students and faculty for the Enbridge-United Way CN Tower Climb in 2009 and 2010. The climb is a charity event in which money is raised for United Way of Canada.

Organiser of WRAPS: Weekly Real Analysis Problem Solving sessions during the summer of 2008, a preparation workshop for students taking the Real Analysis comprehensive exam.

Graduate Student Association Representative for the Department of Mathematics and Statistics of the University of Calgary (2005-2006).

Member of the Bursary and Academic Project Fund Committee, part of the Graduate Student Association at the University of Calgary (2005-2006).

2000-2003 Bryjon Communications – I was initially a transcriber of alpha-numeric pager messages. I then moved to the live answering service, where after a year I became a supervisor over both the answering service and the alpha-numeric transcribers.

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## RECENT CONFERENCES, SCHOOLS & WORKSHOPS

I have attended (or will attend) the following events:

*Groupoidfest 2017* University of Colorado Boulder, Boulder, Colorado, USA; March 2017

*Topology, Stratified Spaces and Particle Physics Summer School* Fields Institute, Toronto, Ontario, Canada; August 2016

*Workshop on Group Actions - Classical and Derived* Fields Institute, Toronto, Ontario, Canada; June 2016

*AMS Sectional Spring Central Meeting 2016* North Dakota State University, Fargo, North Dakota, USA; April 2016

*Groupoidfest 2015 - Special Session on The Analysis, Geometry, and Topology of Groupoids, AMS Fall Southeastern Sectional Meeting*  
University of Memphis, Memphis, Tennessee, USA; October 2015

*Stratified Spaces in Geometric and Computational Topology and Physics*  
University of Wisconsin-Madison, Madison, Wisconsin, USA; March-April 2015

*Infinite-Dimensional Structures in Higher Geometry and Representation Theory*  
Center for Mathematical Physics, Hamburg, Germany; February 2015

*AMS Joint Mathematics Meetings 2015*  
San Antonio, Texas, USA; January 2015

*New Geometries for Physics: Workshop on Diffeology*  
Aix en Provence, France; June 2014

*2014 CMS Summer Meeting*  
Winnipeg, Manitoba, Canada; June 2014

*UIUC-WUSTL Symplectic Geometry Seminar 2014*  
Washington University, St. Louis, Missouri, USA; April 2014

*AMS Joint Mathematics Meetings 2014*  
Baltimore, Maryland, USA; January 2014

*Gone Fishing*  
Temple University, Philadelphia, Pennsylvania, USA; September 2013

*Geometry & Physics (GAP) XI*  
University of Pittsburgh, Pittsburgh, Pennsylvania, USA; August 2013

*Geometry & Physics (GAP) 2013*  
Centre de Recherches Mathématiques, Montreal, Quebec, Canada; May-June 2013

*Souriau's 90*  
Aix-en-Provence, France; June 2012

*Geometry & Physics (GAP) 2012*  
University of Waterloo, Waterloo, Ontario, Canada; May 2012

*Trimester on Contact and Symplectic Geometry*  
Nantes University, Nantes, France; May-June 2011

*Southern Ontario Groups and Geometry Meeting*  
Fields Institute, Toronto, Ontario, Canada; April 2011

*Introductory Workshop: Symplectic and Contact Geometry and Topology*  
MSRI, Berkeley, California, USA; August 2009



*Geometry Summer School*

Instituto Superior Tecnico, Lisbon, Portugal; July 2009

*XVIIIth Oporto Meeting on Geometry, Topology and Physics*

Universidade do Porto, Oporto, Portugal; July 2009

*Great Lakes Geometry Conference*

University of Michigan, Ann Arbor, Michigan, United States; Oct.-Nov. 2008

*Lie Theory & Geometry: The Mathematical Legacy of Bertram Kostant*

University of British Columbia, Vancouver, British Columbia, Canada; May 2008

*Combinatorial Models in Geometry & Topology of Flag Manifolds*

University of Regina, Regina, Saskatchewan, Canada; June 2007

*Alberta Young Researchers Conference*

University of Alberta, Edmonton, Alberta, Canada; April 2006

*Progress in Algebraic Geometry Inspired by Physics*

B.I.R.S., Banff, Alberta, Canada; October 2005

*Moment Maps in Various Geometries*

B.I.R.S., Banff, Alberta, Canada; May 2005

*Alberta Young Researchers Conference*

University of Calgary, Calgary, Alberta, Canada; April 2005