Daniel Mathews

Curriculum Vitæ

Personal Information

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Place of birth:	Melbourne, Australia
Citizenship:	Australian

Appointments

- **Monash University**, Melbourne, Australia.
  Lecturer, 2013–.
- **Contextual Systems**, Melbourne, Australia.
  Mathematician, 2012.
- **Ausralian Mathematical Sciences Institute**, Melbourne, Australia.
  The Improving Mathematics Education in Schools Project, 2012–.
- **Boston College**, Boston, Massachusetts, USA.
  Visiting Assistant Professor, 2010–12.
- **Mathematical Sciences Research Institute**, Berkeley, California, USA.
  Research Member, 2010.
  Program in Symplectic and Contact Geometry and Topology.
- **Université de Nantes**, Nantes, France.
  Postdoctoral fellow, 2009–10.

Research

Interests:

Symplectic and contact topology and geometry

- Algebraic aspects: bounded and higher contact categories, homology theories.
- Functional-analytic aspects: holomorphic curves, sutured Floer homology.
- Combinatorial aspects: convex surfaces, dividing sets, open books.
- Physical aspects: topological quantum field theory, “it from bit”.

Hyperbolic geometry

- Relationship of holonomy and geometric structures.
- Representation and character varieties.
- Hyperbolic cone-manifolds.

Articles and preprints:
(See http://www.danielmathews.info/research for latest versions)

- *Sutured Floer Homology, Sutured TQFT and Non-Commutative QFT*, Algebraic & Geometric Topology 11 (2011) 2681–2739.
- *Chord diagrams, contact-topological quantum field theory, and contact categories*, Algebraic & Geometric Topology 10 (2010) 2091–2189.
- *The hyperbolic meaning of the Milnor–Wood inequality*, Expo. Math. 30 (2012) 1, 49–68.
- *Hyperbolic cone-manifold structures with prescribed holonomy I: punctured tori*, Geometriae Dedicata 152 (2011) 85–128.
- *Hyperbolic cone-manifold structures with prescribed holonomy II: higher genus surfaces*, accepted for publication in Geometriae Dedicata.
- *Sutured TQFT, torsion, and tori*, preprint available at http://arxiv.org/abs/1102.3450.
- *Itsy bitsy topological field theory*, preprint available at http://arxiv.org/abs/1201.4584.
- *Dimensionally-reduced sutured Floer homology as a string homology*, with Eric Schoenfeld, preprint available at http://arxiv.org/abs/1210.7394.
- *Contact topology and holomorphic invariants via elementary combinatorics*, preprint available at http://arxiv.org/abs/1212.1759.

Talks:

- Monash University, December 2012: *Contact topology and holomorphic invariants via elementary combinatorics.*
- Australian and New Zealand Association of Mathematical Physics Inaugural annual meeting, December 2012: *Some field-theoretic ideas out of contact geometry and elementary topology.*
- Geometry and Topology seminar, University of Southern California, April 2012: *Itsy bitsy topological field theory.*
- Geometry and Topology Seminar, MIT, April 2012: *Itsy bitsy topological field theory.*
- Monash University, March 2012: *Itsy bitsy topological field theory.*
- Geometry–Topology Seminar, University of Maryland, November 2011: *Hyperbolic cone-manifolds with prescribed holonomy.*
- Gauge Theory and Topology seminar, Harvard University, May 2011: *Sutured Floer homology and TQFT.*
- Geometry and Topology seminar, Brown University, April 2011: *Sutured topological quantum field theory.*
- Geometric Topology seminar, Columbia University, October 2010: *Hyperbolic cone-manifolds with prescribed holonomy.*
- Sutured Floer homology seminar, Columbia University, October 2010: *Sutured topological quantum field theory and contact elements in sutured Floer homology.*
- Geometry/Topology Seminar, Boston College, September 2010: *Sutured topological quantum field theory and contact elements in sutured Floer homology.*

- Workshop on Geometry, Topology and Dynamics of Character Varieties, Institute for Mathematical Sciences, National University of Singapore, July 2010: *Hyperbolic cone-manifolds with prescribed holonomy.*
- Séminaire de Topologie, Institut Mathématiques de Jussieu, Paris, May 2010: *Sutured Floer homology and contact-topological quantum field theory.*
- Séminaire Géométries, Institut Camille Jordan, Lyon, May 2010: *Sutured Floer homology and contact-topological quantum field theory.*
- Seminar on symplectic and contact geometry, Université Libre de Bruxelles, April 2010: *Sutured Floer homology and contact-topological quantum field theory.*
- 3- and 4-Manifold Seminar, Michigan State University, April 2010: *Sutured topological quantum field theory and contact elements in sutured Floer homology.*
- Geometry/Topology Seminar, Uppsala Universitet, February 2010: *Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories.*
- Algebra–Geometry–Topology seminar, University of Melbourne, January 2010: *Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories.*
- Topology seminar, Université de Grenoble, December 2009: *Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories*
- Topology seminar, Université de Grenoble, December 2009: *Hyperbolic cone-manifold structures with prescribed holonomy*
- Algebra–topology seminar, Universitéde Nantes, December 2009: *Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories*
- Series of four talks on Ph.D. work, Université de Nantes, October–December 2009: *Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories*
- Symplectic geometry and gauge theory seminar, Columbia University, April 2009: *Chord diagrams, topological quantum field theory, and the sutured Floer homology of solid tori.*
- Symplectic geometry seminar, Stanford University, March 2009: *Chord diagrams, topological quantum field theory, and the sutured Floer homology of solid tori.*
- Symplectic progress seminar, Stanford University, November 2008: *Catalan numbers and sutured Floer homology.*
- Manifolds at Melbourne conference, University of Melbourne, January 2006: *Construction of geometric cone-manifold structures with prescribed holonomy.*
- Topology seminar, University of Melbourne, July 2005: *Construction of geometric cone-manifold structures with prescribed holonomy.*

Other publications:

- *Mathematical Olympiad Lectures* (in progress, joint with A. Di Pasquale and N. Do.)

Recreational articles:

- *A Beautiful Sequence*, Aust. M. S. Gazette, Vol. 31 No. 1 (2004)
- *Games with Galois*, Aust. M. S. Gazette, Vol. 31 No. 2 (2004). Reprinted in *Vinculum*, No. 4 (2007). the Mathematical Association of Victoria professional journal for Victorian mathematics teachers.
- *Quadratic geography, algebraic extreme sports and magical Farey trees*, Aust. M. S. Gazette, Vol. 31 No. 3 (2004)
- *Knot Man* (comic; illustrator Priscilla Brown): 4 issues available, published in Paradox, the magazine of the Melbourne University Mathematics and Statistics Society.

Teaching Experience

At Boston College:

Spring 2012 **Lecturer, graduate geometry/topology**:
Math 832, Geometry/Topology IV, the fourth course in the BC graduate geometry/topology sequence. *A course being held for the first time.* Focus on symplectic and contact geometry and topology. Responsible for building the course from scratch: selection of content and subject matter, preparing and delivering lectures, assigning and grading homework and writing solutions, conducting assessment. Two students.

2011 – 2012 **Lecturer, undergraduate abstract mathematics**:
One section of Math 216 each semester, Introduction to Abstract Mathematics. Responsible for all aspects of the course: preparing and delivering lectures, assigning homework, preparing homework solutions, co-ordinating grading, holding office hours, writing tests, grading exams. Approximately 20 students each class.

Spring 2011 **Lecturer, complex variables**:
One section of Math 460, Complex Variables. Responsible for all aspects of the course, including lectures, homework, solutions, office hours, and exminations. Approximately 30 students.

Fall 2010 **Lecturer, calculus**:
Two sections of Math 105, calculus II-AP for math and science majors. Responsible for all aspects of the course: preparing and delivering lectures, assigning homework, preparing homework solutions, co-ordinating grading, holding office hours, writing and setting tests, grading exams. Approximately 80 students total.

2010– **Putnam Problem Sessions**:
With other faculty, lead problem sessions exploring challenging problems.

At Stanford University:

2009 **Course Assistant**:
Math 51, linear algebra and multivariable calculus. Responsible for leading sections, holding office hours, and grading exams.

2008 **Course Assistant**:
Math 215C, first year graduate topology. Responsible for grading homework and exams, holding office hours and giving some lectures.

2008 **Teaching Assistant**:
Math 51, linear algebra and multivariable calculus. Responsible for leading sections, holding office hours, and grading exams.

2007 **Course Assistant**:
Math 175, functional analysis. Responsible for grading homework and holding office hours.

2006 **Teaching Assistant**:
Math 41, calculus. Responsible for leading section, holding office hours, and grading exams.

2006 **Course Assistant**:
Math 116, complex analysis. Responsible for grading homework, holding office hours and giving some lectures.

2005 **Teaching Assistant**:
Math 51, linear algebra and multivariable calculus. Responsible for leading sections, holding office hours, and grading exams.

2005 **Course Assistant**:
Math 20, calculus. Responsible for grading and holding office hours.

2004 **Course Assistant**:
Math 120, group theory. Responsible for holding office hours, grading exams and writing homework solutions.

Summer camp:

2007 **Teaching Assistant at Stanford University Mathematics Camp (SUMaC)**:
Responsible for meeting with several students individually every day to discuss their experiences at the camp and to explain mathematics.

Mathematical Olympiad:

2002–04 **Deputy Leader of Australian team at International Mathematics Olympiad**:
Glasgow 2002, Tokyo 2003, Athens 2004

1998–04 **Lecturer, tutor, grader, administrator**:
In residence at biannual 10-day residential camps biannually 1999–2004.
At IMO training camps and IMO 2002–2004.

Other teaching:

- Mentoring talented high-school students:
Scotch College 1998-2004; Penleigh & Essendon Grammar School 2001-2003
- Private tutoring.

Education

- **Stanford University**, Stanford, California.
Ph.D. in Mathematics, 2009.
Thesis: *Chord diagrams, contact-topological quantum field theory, and contact categories*.
Advisors: Yakov Eliashberg, Steven Kerckhoff.
- **University of Melbourne**, Melbourne, Australia.
M.Sc. in Mathematics, 2004.
Thesis: *From Algebra to Geometry: A Hyperbolic Odyssey — The construction of geometric cone-manifold structures with prescribed holonomy.*
Supervisor: Craig Hodgson
- **University of Melbourne**, Melbourne, Australia.
B.Sc. (Hons) in Mathematics, L.L.B. (Hons), Dip.Mod.Lang. (Italian)
Thesis: *Mahler's Unfinished Symphony: Études in Knots, Algebra and Geometry.*
Supervisor: Craig Hodgson

Conferences Attended

05-06/11 **Trimester on Contact and Symplectic Topology**:
Université de Nantes, France.

06/10 **Istanbul Contact Geometry and Topology Workshop**:
Bogazi ci University, Istanbul.

05/10 **Seventeenth Gökova Geometry/Topology Conference**:
Gökova, Turkey.

01/10 **Workshop on Symplectic Geometry, Cotnact Geometry and Interactions**:
Institut Henri Poincaré, Paris.

07/09 **1st PRIMA Congress**:
University of New South Wales.

08/08 **Workshop on Holomorphic Curves**:
Stanford University.

07/08 **Workshop on Symplectic Field Theory III**:
Humboldt University, Berlin.

07/07 **New Perspectives and Challenges in Symplectic Field Theory — a Conference in Honour of Yasha Eliashberg's 60th Birthday**:
Stanford University.

08/06 **Workshop on Symplectic Field Theory II**:
Universität Leipzig.

06/06 **IAS / Park City Mathematics Institute Summer Session**:
Park City, Utah.

03/06 **3-manifolds after Perelman**:
Heriot-Watt University, Edinburgh.

01/06 **Manifolds at Melbourne**:
University of Melbourne.

05/05 **3-manifolds and knot theory**:
University of Texas at Austin.

Other activities

2012– Australian Mathematical Sciences Institute (AMSI), The Improving Mathematics in School (TIMES) Project. Writing modules for secondary teachers on the various topics in the Australian Curriculum, to give them required knowledge, and additional interesting background, in an engaging way.

2001– Australian Mathematical Olympiad Committee, Senior Problems Committee.

2001 President, Melbourne University Mathematics Society.

Awards

1999–03 Rowden White Prize 2002; Dean's Honours List 2000; JR Maguire Exhibition 1999 (highest ranked student in Criminal Law); Dean's Prize in Science 1998; Melbourne University Law Review 1999-2003.

1998–02 Melbourne University National Scholarship.

1997–8 First Place in the State in VCE 1997. Australian Students Prize for Excellence 1997, 1998. Premier's prizes in mathematics, physics.

1996–7 Represented Australia at the International Mathematical Olympiad.
Mar del Plata, Argentina 1997 — silver medal.
Mumbai, India 1996 — bronze medal.

Other interests

- **Music**:
Stanford Wind Ensemble, 2005–07. Victorian Youth Symphony Orchestra (self-managed amateur orchestra), 1998-2004: secretary, webmaster, principal French Horn.
- **Human rights:**
Amnesty International, Initiative for Equality, Peace & Justice organisations.
- **Miscellaneous:**
Physics, astronomy, programming, world politics, international law, environmental policy, alternative economics, linguistics, music composition, philosophy, economic history, beer brewing.

References

- **Julia Elisenda (Eli) Grigsby** (Assistant Professor, Boston College):
`grigsbyj@bc.edu`
- **Yakov Eliashberg** (Professor, Stanford University):
`eliash@math.stanford.edu`
- **Craig Hodgson** (Associate Professor & Reader, University of Melbourne):
`c.hodgson@ms.unimelb.edu.au`

Additional references:

- **Vincent Colin** (Professeur, Université de Nantes):
`Vincent.Colin@univ-nantes.fr`
- **Steven Kerckhoff** (Professor & Chair, Stanford University):
`spk@geom.stanford.edu`
- **Bill Keane** (Assistant Chair, Undergraduates, Boston College):
`keane@bc.edu` (teaching reference)