Daniel Mathews

Curriculum Vitæ

Personal Information

Address:	c/- School of Mathematics
	Monash University, VIC 3800
Phone:	9902 4941 (office)
Email:	Daniel.Mathews@monash.edu
Web:	danielmathews.info
Date of birth:	26 November 1979
Place of birth:	Melbourne, Australia
Citizenship:	Australian

Appointments

- **Monash University**, Melbourne, Australia.
  Associate Professor, 2022–
  Senior Lecturer, 2018–22
  Lecturer, 2013–17.

- **Nanyang Technological University**, Singapore.
  Visiting Associate Professor, 2024.

- **Contextual Systems**, Melbourne, Australia.
  Mathematician, 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:

Hyperbolic geometry and quantum topology

- Hyperbolic structures on manifolds, Neumann-Zagier matrices
- Representation and character varieties, A-polynomials
- Quantum invariants, coloured Jones polynomials
- Algebraic aspects: skein algebras, cluster algebras

Contact and Symplectic topology and geometry

- Algebraic aspects: contact categories, string homology, A_∞ structures.

- Floer homology: sutured, bordered, strands algebras, contact invariants
- Combinatorial aspects: convex surfaces, dividing sets, open books.

Mathematical physics

- Topological quantum field theory
- Quantum information, "it from bit"
- Algebraic aspects: quantum groups, Clifford algebras, spin(ors)
- Topological recursion, quantum curves

Published research articles:

- *A symplectic basis for 3-manifold triangulations*
  with J. S. Purcell. Accepted for publication in *Communications in Analysis and Geometry*, 28 November 2024.
  Preprint available at `https://arxiv.org/abs/2208.06969`.

- *A-polynomials, Ptolemy varieties and Dehn filling*
  with J. A. Howie, J. S. Purcell. Accepted for publication in *Algebraic & Geometric Topology*, 25 March 2024.
  Preprint available at `https://arxiv.org/abs/2002.10356`.

- *A-Polynomials of fillings of the Whitehead sister*
  with J. A. Howie, J. S. Purcell, E. K. Thompson. Internat. J. Math. 34 (2023), no. 13, Paper No. 2350085, 20 pp.

- *The sensitivity conjecture, induced subgraphs of cubes, and Clifford algebras*
  J. Eur. Math. Soc. (JEMS) 24 (2022), no. 12, 4201–4205.

- *Counting non-crossing permutations on surfaces of any genus*
  with N. Do, J. He, Electron. J. Combin. 28 (2021), no. 4, Paper No. 4.9, 47 pp.

- *A-infinity algebras, strand algebras, and contact categories*
  Algebr. Geom. Topol. 21 (2021), no. 3, 1093–1207.

- *Tight contact structures on Seifert surface complements*
  with T. Kálmán, J. Topol. 13 (2020), no. 2, 730–776.

- *Strand algebras and contact categories*
  Geom. Topol. 23 (2019), no. 2, 637–683.

- *Polytopes, dualities, and Floer homology*
  Gromov-Witten theory, gauge theory and dualities, Proceedings of the Centre for Mathematics and its Applications, ANU, Canberra (2019) 133-173.

- *Morse structures on partial open books with extendable monodromy*
  with J. E. Licata, 2016 MATRIX annals, 287–303, MATRIX Book Ser., 1, Springer, Cham, 2018.

- *Topological recursion and a quantum curve for monotone Hurwitz numbers*
  with N. Do & A. Dyer, J. Geom. Phys. 120 (2017), 19–36.

- *Counting curves on surfaces*
  with N. Do and M. Koyama, Internat. J. Math. 28 (2017), no. 2, 1750012, 105 pages

- *Strings, fermions and the topology of curves on annuli*
  J. Symplectic Geom. 15 (2017), no. 2, 421–506.

- *Dimensionally-reduced sutured Floer homology as a string homology*
  with E. Schoenfeld, Algebr. Geom. Topol. 15 (2015), no. 2, 691–731

- *Twisty itsy bitsy topological field theory*
  Internat. J. Math. 25 (2014), no. 10, 1450097, 68 pages
- *An explicit formula for the A-polynomial of twist knots*
  J. Knot Theory Ramifications 23 (2014), no. 9, 1450044, 5 pages
- *Itsy bitsy topological field theory*
  Ann. Henri Poincaré 15 (2014) 9, 1801–1865.
- *Contact topology and holomorphic invariants via elementary combinatorics*
  Expo. Math. 32 (2014) 2, 121–160.
- *Sutured TQFT, torsion, and tori*
  Internat. J. Math. 24 (2013) 5, 1–35.
- *The hyperbolic meaning of the Milnor–Wood inequality*
  Expo. Math. 30 (2012) 1, 49–68.
- *Hyperbolic cone-manifold structures with prescribed holonomy II: higher genus surfaces*
  Geom. Dedicata 160 (2012) 15–45.
- *Sutured Floer Homology, Sutured TQFT and Non-Commutative QFT*
  Algebr. Geom. Topol. 11 (2011) 5, 2681–2739.
- *Hyperbolic cone-manifold structures with prescribed holonomy I: punctured tori*
  Geom. Dedicata 152 (2011), 85–128.
- *Chord diagrams, contact-topological quantum field theory, and contact categories*
  Algebr. Geom. Topol. 10 (2010) 4, 2091–2189.

Preprints:

- *Quaternionic spinors and horospheres in 4-dimensional hyperbolic geometry*
  with Varsha. Preprint available at `https://arxiv.org/abs/2412.06572`
- *From spinors to horospheres: a geometric tour*
  with Varsha. Preprint available at `https://arxiv.org/abs/2412.10862`
- *Triangulations of the 3-sphere with knotted edge*
  with D. Ibarra, J. S. Purcell, J. Spreer. Submitted for publication.
  Preprint available at `https://arxiv.org/abs/2411.18938`
- *Lambda lengths in The figure eight knot complement*
  with J. A. Howie, D. Ibarra, L. Su. Submitted for publication.
  Preprint available at `https://arxiv.org/abs/2411.06368`
- *Spinors and Descartes' Theorem*
  with O. Zymaris. Submitted for publication.
  Preprint available at `https://arxiv.org/abs/2310.11701`.
- *Spinors and horospheres*
  Submitted for publication.
  Preprint available at `https://arxiv.org/abs/2308.09233`.

Books published:

- *Specialist Mathematics: VCE Units 3 & 4*
  Cambridge Senior Mathematics VCE: Second edition
  joint with M. Evans, D. Treeby, K. Lipson, J. Astruc, N. Cracknell, G. Ainsworth
  published by Cambridge University Press, 2023
- *Problem solving tactics*
  joint with A. Di Pasquale and N. Do
  published by Australian Mathematics Trust, 2014

Grants awarded:

- *Connections in low-dimensional topology*
  ARC Discover Project DP210103136
  joint with J. Purcell
- *Quantum invariants and hyperbolic manifolds in three-dimensional topology*
  ARC Discovery Project DP160103085
  joint with J. Purcell

Research student supervision:

PhD students

- Orion Zymaris (75%, primary supervisor), 2022–
- Lavender Marshall (90%, primary supervisor), 2024–
- Lecheng Su (20%, secondary supervisor), 2022–
- Emma McQuire (10%, secondary supervisor), 2024–
- Corbin Reid (20%, secondary supervisor), 2023–
- Em Thompson (40%, secondary supervisor), 2020–2024.
  Thesis: "On layered triangulations of 3-manifolds: a motivation, a generalisation, and an application".
- Tung Le (75%, primary supervisor), 2015–2024.
  Thesis: "Kauffman's clock theorem and its generalisation to more complicated structures and surfaces".
- Anupam Chaudhuri (25%, secondary supervisor), 2016–2020.
  Thesis: "One-point recursions and topological recursion for enumerative problems".

Masters students

- Varsha (50%, primary supervisor) 2022
  Thesis: "Spinors and Space-time"
- Xueyu (Eileen) Pan (10%, secondary supervisor) 2019–2021
  Thesis: "Groups of small order type"
- John Stewart (10%, secondary supervisor) 2019–2021
  Thesis: "Constructing Knot Complements with Specified Geometric Limits"

Honours students

- Nicola Harif 2024
  Thesis: "Horospheres and Imaginary Quadratic Fields of Heegner Numbers"
- Katie Green 2024
  Thesis: "Using symplectic geometry to classify symmetric orbits in the circular restricted three-body problem"
- Joshua Childs 2023
  Thesis: "Oscillating curves on triangulated 3-manifolds"
- Orion Zymaris 2021
  Thesis: "Geometric Quantisation, the Poincaré Group, and the Coadjoint Orbit Method"
- Ben Willey 2020
  Thesis: "A Proof of the Non-Squeezing Theorem'"

- Will Veenman 2020
  Thesis: "Alexander Polynomials and Grid Homology for Links"
- Peizheng Ni 2019
  Thesis: "Counting Curves on Surfaces"
- Jayden Hammet 2018
  Thesis: "Classifying Topological Quantum Field Theories'"
- Xueyu Pan 2018
  Thesis: "An Introduction to the Coloured Jones Polynomial"
- Emily Thompson 2018
  Thesis: "The algebra and topology of the A-polynomial"
- Joshua Grant 2015–16
  Thesis: "Combinatorial Heegaard Floer Homologies"
- Michelle Strumila 2015
  Thesis: "Functors from Algebra to Topology: TQFTs, Contact Geometry and Automata"
- Alastair Dyer 2014 (joint supervision with N. Do)

Vacation research students

- Oscar Eden 2022–23 (jointly supervised with Jian He)
  Project: "Knots and combinatorics'"
- Emma McQuire 2021–22 (jointly supervised with Jian He)
  Project: "Knots & Combinatorics"
- Peizheng Ni 2016–17
  Project: "Counting Curves on Surfaces"
- Musashi Koyama 2014–15
  Project: "Computing with Topology"
- Angus Southwell 2014–15
  Project: "Knots, cords and skeins"
- Joshua Grant, Michelle Strumila 2013–14

Undergraduate research projects

- Michael Wynne 2022
  Project: "Hyperbolic Geometry"
- Corbin Reid 2021
  Project: "The Hyperbolic Plane"
- Benedict Lee 2019
  Project: "Skein Modules, Skein Algebra and Quantisation"
- Thomas Leatham 2018
  Project: "Symplectic geometry and its applications in physics"
- Stephen Deng 2016
  Project: "Topics in symplectic geometry"
- Musashi Koyama 2015
  Project: "Hyperbolic Geometry"
- Alastair Dyer 2013
  Project: "2 Dimensional Topological Quantum Field Theories and Frobenius Algebras"

- Jake Antmann 2013
  Project: "A brief introduction to Symplectic Geometry"
- Colin Andrews 2013
  Project: "Hyperbolic geometry"
- Benjamin Jones 2013
  Project: "An Introduction to Symplectic Geometry"

Research talks:

12/24	Topology, Geometry and Dynamics seminar, National University of Singapore *Spinors and lambda lengths*
08-09/24	Series of five talks, mini-course, Nanyang Technological University, Singapore *Hyperbolic geometry and spinors*
04/23	Monash Topology seminar *Spinors and horospheres*
02/23	Australia and New Zealand Association of Mathematical Physics (ANZAMP) annual meeting, Hobart *The geometry of spinors in Minkowski space*
11/22	Oklahoma State University Topology seminar *Symplectic structures in hyperbolic 3-manifold triangulations*
09/22	Yau Mathematics Sciences Center Topology seminar, Tsinghua University *A symplectic approach to 3-manifold triangulations and hyperbolic structures*
09/22	Monash Topology seminar *A symplectic approach to 3-manifold triangulations and hyperbolic structures*
04/22	Knots in Washington 49.75 *A Symplectic Basis for 3-manifold Triangulations*
12/21	Australian Mathematical Society Annual Meeting, virtual (University of Newcastle) *A Symplectic Basis for 3-manifold Triangulations*
11/21	Series of 4 talks at *Knot Days*, virtual (ANU) *The Jones Polynomial and Volume Conjectures*
09/21	Monash Data Futures Institute, MDFI lightning talk on Topological Data Analysis
12/20	Australian Mathematical Society Annual Meeting, virtual (University of New England) *Ptolemy vs Thurston in Hyperbolic Geometry & Topology*
06/20	Topology Seminar, University of Melbourne *A-polynomials, Ptolemy varieties, and Dehn filling*
04/20	Topology Seminar, Monash University *Circle packings, Lagrangian Grassmannians, and Scattering Diagrams*
12/19	Australian Mathematical Society Annual Meeting, Monash University *Geometry and physics of circle packings*
09/19	Discrete Mathematics Seminar, Monash University *The sensitivity conjecture, induced subgraphs of cubes, and Clifford algebras*
08/19	Topology Seminar, Monash University *The sensitivity conjecture, induced subgraphs of cubes, and Clifford algebras*
09/18	Colloquium, Nanyang Technological University, Singapore *"The beauty of mathematics shows itself to patient followers": The work of Maryam Mirzakhani*

09/18 Topology and Geometry Seminar, National University of Singapore
Counting curves on surfaces

08/18 Yashafest - Conference on geometric methods in symplectic and contact topology in honor of Yakov Eliashberg
Algebra and geometry of contact categories

08/18 Topology Seminar, University of Melbourne
The algebra and topology of contact categories

11/17 Mathematics of consciousness seminar, Monash University
Some pure mathematics and consciousness

10/17 Geometry & Topology Seminar, University of Sydney
Plane graphs, special alternating links, and contact geometry

09/17 Tutte Centenary Celebration, Monash University
The Tutte polynomial and knot theory

12/16 Australian Mathematical Society Annual Meeting, ANU
Strand algebras and contact categories

11/16 MSI Workshop on Low-Dimensional Topology & Quantum Algebra, ANU
Strand algebras and contact categories.

10/16 MSI Workshop on Low-Dimensional Topology & Quantum Algebra, ANU
An introduction to contact geometry and topology.

04/16 University of Melbourne
Hyperbolic volume and the Mahler measure of the A-polynomial.

01/16 Workshop on Gromov-Witten theory, Gauge Theory, an Dualities, ANU Kioloa
Trinities, sutured Floer homology, and contact structures.

09/15 Australian Mathematical Society Annual Meeting, Flinders University
Counting curves on surfaces.

05/15 University of Melbourne, *The A-polynomial, symplectic geometry, and quantisation*.

02/15 Topology seminar, Tokyo Institute of Technology
Contact topology and holomorphic invariants via elementary combinatorics.

12/14 Australia New Zealand Mathematics Convention, University of Melbourne
Strings, fermions and the topology of curves on surfaces.

10/14 University of Melbourne, *Strings, fermions and the topology of curves on surfaces*.

05/14 Monash University, *Discrete Contact Geometry*.

04/14 University of Melbourne
Gopakumar-Vafa invariants of toric Calabi-Yau threefolds (joint with N. Do).

09/13 Australian Mathematical Society Annual Meeting, University of Sydney
A Yang-Baxter equation from sutured Floer homology.

05/13 University of Melbourne
Sutures, quantum groups and topological quantum field theory.

04/13 Australian National University
Contact topology and holomorphic invariants via elementary combinatorics.

12/12 Monash University
Contact topology and holomorphic invariants via elementary combinatorics.

12/12 Australian and New Zealand Association of Mathematical Physics Inaugural Meeting:
Some field-theoretic ideas out of contact geometry and elementary topology.

04/12 University of Southern California, *Itsy bitsy topological field theory.*

04/12 MIT, *Itsy bitsy topological field theory.*

03/12 Monash University, *Itsy bitsy topological field theory.*

11/11 University of Maryland, *Hyperbolic cone-manifolds with prescribed holonomy.*

05/11 Harvard University, *Sutured Floer homology and TQFT.*

04/11 Brown University, *Sutured topological quantum field theory.*

10/10 Columbia University, *Hyperbolic cone-manifolds with prescribed holonomy.*

10/10 Columbia University, *Sutured topological quantum field theory and contact elements in sutured Floer homology.*

09/10 Geometry/Topology Seminar, Boston College: *Sutured topological quantum field theory and contact elements in sutured Floer homology.*

07/10 Workshop on Geometry, Topology and Dynamics of Character Varieties, National University of Singapore, *Hyperbolic cone-manifolds with prescribed holonomy.*

05/10 Institut Mathématiques de Jussieu, Paris
Sutured Floer homology and contact-topological quantum field theory.

05/10 Séminaire Géométries, Institut Camille Jordan, Lyon
Sutured Floer homology and contact-topological quantum field theory.

04/10 Université Libre de Bruxelles,
Sutured Floer homology and contact-topological quantum field theory.

04/10 Michigan State University, *Sutured topological quantum field theory and contact elements in sutured Floer homology.*

02/10 Uppsala Universitet
Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories.

01/10 University of Melbourne
Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories.

12/09 Université de Grenoble
Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories

12/09 Université de Grenoble, *Hyperbolic cone-manifold structures with prescribed holonomy*

12/09 Université de Nantes
Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories

10–12/09 Series of four talks on Ph.D. work, Université de Nantes
Chord Diagrams, Contact-Topological Quantum Field Theory, and Contact Categories

04/09 Columbia University: *Chord diagrams, topological quantum field theory, and the sutured Floer homology of solid tori.*

03/09 Stanford University, *Chord diagrams, topological quantum field theory, and the sutured Floer homology of solid tori.*

11/08 Stanford University, November 2008, *Catalan numbers and sutured Floer homology.*

01/06 Manifolds at Melbourne conference, University of Melbourne
Construction of geometric cone-manifold structures with prescribed holonomy.

07/05 University of Melbourne, July 2005
Construction of geometric cone-manifold structures with prescribed holonomy.

Conferences attended:

06/24 *Low Dimensional Topology: Invariants of Links, Homology Theories, and Complexity*, MATRIX

02/23 *Australia and New Zealand Association of Mathematical Physics (ANZAMP) Meeting*, Hobart

11/22 *Indigenizing University Mathematics 2*, First Nations University of Canada, University of Newcastle

09/22 *Australian Conference on Science and Mathematics Education (ACSME)*, University of Western Australia

07/22 $(GT)^3$*: Graduate Talks in Geometric Topology Get-Together*, MATRIX

04/22 *Knot in Washington 49.75*, George Washington University (online)

12/21 *Australian Mathematical Society Annual Meeting*, University of Newcastle (online)

11/21 *Knot Days*, ANU

09/21 *Indigenizing University Mathematics*, CARMA, University of Newcastle

09/21 *MATRIX-MFO Tandem Workshop: Invariants and Structures in Low-Dimensional Topology*

07/21 *Computational & Algorithmic Topology, Sydney*, The University of Sydney (online)

01/21 *Floer Theory and Hamiltonian Dynamics of Non-Compact Hypersurfaces* (online)

12/20 *64th Annual Meeting of the Australian Mathematical Society*, University of New England (online)

06/20 *Interactions of gauge theory with contact and symplectic topology in dimensions 3 and 4*, Banff International Research Station (Online)

01/20 *Geometry of Quantum Fields and Strings*, University of Auckland

12/19 *63rd Annual Meeting of the Australian Mathematical Society*, Monash University

07/19 *IAS / Park City Mathematics Institute*, Park City, Utah, USA

12/18 *Classical and quantum three-manifold topology*, Monash University

09/18 *Dynamics, Foliations, and Geometry in Dimension 3*, MATRIX, Creswick

08/18 *Yashafest - Conference on geometric methods in symplectic and contact topology in honor of Yakov Eliashberg*, Stanford University

12/17 *Australian Mathematical Society Annual Meeting*, Macquarie University

09/17 *Australian Conference on Science and Mathematics Education*, Monash University

09/17 *The 60th birthday of Amnon Neeman Conference*, ANU

06–07/17 *Computational & Algorithmic Topology, Sydney*, The University of Sydney

11–12/16 *Interactions between Topological Recursion, Modularity, Quantum Invariants and Low-Dimensional Topology*, MATRIX.

12/16 *Australian Mathematical Society Annual Meeting*, ANU.

10-11/16 *MSI Workshop on Low-Dimensional Topology & Quantum Algebra*, ANU

07/16 *Knots in Hellas 2016*, International Olympic Academy, Ancient Olympia, Greece.

01/16 *Gromov–Witten Theory, Guage Theory and Dualities*, Kioloa, ANU

09-10/15 *Australian Mathematical Society Annual Meeting*, Flinders University, Adelaide.

06/15 *CURVE 2015*, Institut de Mathématiques de Jussieu, Paris.

12/14 *8th Australia New Zealand Mathematics Convention*, University of Melbourne.

07/14 *The Geometry, Topology and Physics of Moduli Spaces of Higgs Bundles*
Institute for Mathematical Sciences, National University of Singapore.

12/13 *Australia and New Zealand Association of Mathematical Physics (ANZAMP) conference*,
Mooloolaba, Queensland

09/13 *Australian Mathematical Society Annual Meeting*, University of Sydney.

07/13 *Low dimensional topology after Floer*, Centre de Recherche Mathématiques, Montréal.

12/12 *Australian and New Zealand Association of Mathematical Physics (ANZAMP) Inaugural
Conference*, Lorne, Victoria.

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

07/10 *Workshop on Geometry, Topology and Dynamics of Character Varieties*
Institute for Mathematical Sciences, National University of Singapore.

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, Contact 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.

Teaching

National / International events

07/2019 **Institute for Advanced Study / Park City Mathematics Institute Undergraduate
Summer School**:
Low-dimensional topology. Together with Prof Jessica Purcell taught an intensive 3-
week course to top undergraduate students, high school teachers, and others, from
around the United States.

01/2018 **AMSI Summer School**:
Low-Dimensional Topology. Together with Prof Jessica Purcell taught an intensive
4-week course to top undergraduate mathematics students from around Australia.

At Monash University:

2013– **Lecturer & unit coordinator, first year calculus**:
MTH1020 Analysis of Change. Enrolment growing to 400-500. Implemented active
learning techniques in lectures and applied classes. Extensive rewriting and improve-
ment of lecture materials. Strengthening course content. Expanding and improving
problem sets and solutions. Rearrangement of curriculum, results boosted. Lectures
of over 200 students. Writing assignments, problem sets, solutions, exams, marking
schemes. Co-ordinating up to 20 tutors, 4 lecturers, markers.

2013– **Lecturer & unit coordinator, differential geometry**:
An advanced undergraduate course MTH3110 on the differential geometry of curves and surfaces. Writing extensive new lecture notes / textbook. Producing/editing video content. Expanding and improving problem sets and solutions. Preparing and delivering lectures. Writing assignments and solutions, co-ordinating tutors and lecturers, teaching support classes, writing and grading exams. Enrolment around 30–50 students.

2013–15 **Lecturer, honours topology**:
M4051 Topology, an advanced topology course for honours students. Responsible for all aspects of the course: content, lectures, writing and grading homework and exams, preparing solutions, office hours. Approximately 5 students.

2014–17 **Lecturer, mathematics extension for secondary students**:
MTH1040 Mathematics Extension, a course for high-achieving Year 12 students covering first-year university mathematics. Responsible for preparing and delivering 12 weeks of lectures introducing secondary students to concepts such as limits, differential and integral calculus, and differential equations. Approximately 25 students.

2015–16 **Mathematics Learning Centre videos**:
Recorded several videos for use of undergraduate students, on various topics across the undergraduate curriculum: inverse function theorem, single & multivariable calculus, topology, etc.

At Boston College:

2012 **Lecturer, graduate geometry/topology**:
Math 832 Geometry/Topology IV, a graduate course on symplectic and contact geometry and topology, *held for the first time, built from scratch*. Responsible for selection of content, preparing and delivering lectures, assigning and grading homework and writing solutions, conducting assessment. Two students.

2011–12 **Lecturer, undergraduate abstract mathematics**:
Math 216, Introduction to Abstract Mathematics. Responsible for all aspects of the course, including lectures, homework, solutions, office hours, writing tests, and grading exams. Approximately 20 students.

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

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.

2010–12 **Putnam Problem Sessions**:
With other faculty, lead problem sessions exploring challenging problems.

At Stanford University:

2005–9 **Course & Teaching Assistant, calculus**:
Various undergraduate subjects on calculus, linear algebra, and multivariable calculus. Responsible for leading sections, holding office hours, and grading exams.

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

2007 **Course Assistant, functional analysis**:
Math 175, an advanced undergraduate course on functional analysis. Responsible for grading homework and holding office hours.

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

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

Mathematical Olympiad:

2012– **Lecturer**:
Lectures at December School of Excellence, held at University of Melbourne.

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

Talented secondary students:

2013– **Australian Mathematics Competition workshops**: Problem-solving workshops with competition winners / high-achieving students, each year.

2015 Genazzano FCJ College

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

1998–2004 Scotch College

2001–2003 Penleigh & Essendon Grammar School

Service, engagement

At Monash University:

2022– **School Executive Committee**: Representing equity concerns on the committee.

2021– **Maths Grant Group**: Enhancing school ability to earn ARC grants and find new grant opportunities, playing a strategic role. Reviewing applications, guiding applicants.

2020–21 **Co-chair, HDR recruitment committee**: recruitment of HDR (higher degree by research) students, domestic and international. Providing information to academics to facilitate HDR student supervision.

2020–23 **Pure mathematics coordinator, School of Mathematics**: signing off on exams, giving course and unit advice.

2020– **Board of Examiners, School of Mathematics**

2019– **Faculty of Science Gender Equity Committee**: Promoting gender equity throughout the faculty. Member representing School of Mathematics.

2019– **Chair of School of Mathematics Equity Committee**: Responsible for promoting equity, inclusion and diversity, including gender equity, within the school. Organising workshops for women in mathematics. Talks on issues relating to equity in mathematics, such as gender equity, Indigenous mathematics. Special events such as *Autralian Women in Mathematics* portrait exhibition. Overseeing the establishment of a mentoring program for undergraduate students of underrepresented genders. Talks/panels/seminars/events hosted:

03/20 Luise-Charlotte Kappe (Binghamton Univerisity), "It's a wonderful life: Reflections on a career as a mathematician'"

05/20 Jennifer Hall (Monash), "Undergraduate Students' Experiences in the School of Mathematics at Monash University"

04/21 Women in Mathematics panel: Ariella Jones, Tess Guthrie, Vaashini Murugadasan

05/21 Michael Donovan (Macquarie), Judy-Anne Osborn (Newcastle)

07/21 Faculty of Science seminar on Caring Responsibilities: Daniel Mathews (moderator), Robin Armit, Victoria Blair, Amelia Liu, Anne Peters, Lincoln Turner

09/21 Women in Mathematics panel: Ellena Moskovsky, Jennifer Ralph, Siksha Sivaramakrishnan

10/21 Jennifer Hall, Travis Robinson (Monash), "Accounts of Graduate Students in Mathematics: Exploring Experiences Related to Gender and Mental Health"

04/22 Women in Mathematics panel: Alex de Lacy, Lucinda Boffa

05/22 Australian Women of Mathematics, Exhibition opening

09/22 Women in Mathematics panel: Lizzy Cooper, Kelly Maynard, Jess Suares

05/23 Gender Equity in Mathematics panel: Natalie Artenstein, Emma Link, Sameera Tadikonda

2019–23 **Credit assessments:** Assessing courses from other universities against Monash studies.

2018–23 **Deputy Postgraduate Coordinator**: Assist postgraduate coordinator in matters regarding postgraduate student research and life.

2016–18 **DATUM project**: peer feedback on teaching for support and development.

2016– **Hiring committees**: Sat on several committees for hiring top calibre mathematicians.

2014–19 **LunchMaths**: Organiser (joint with N. Do and several students) of LunchMaths at Monash: informal talks for interested undergraduates, at lunch time, by researchers in mathematical sciences.

2013–19 **Pure maths meetups**: Organiser (joint with N. Do) or pure maths meetups: inflrmal gatherings where fun maths topics outside the usual undergraduate syllabus are discussed.

2013– **Curriculum development**: Participated in overhaul of undergraduate mathematics curriculum at Monash.

2013– **Assessing honours and postgraduate students**: Marking honours theses, sat on many PhD and Masters milestone panels.

External reviewing

2018– **External thesis examiner**: Marking masters and PhD theses of postgraduate students at other universities.

2018– **International reviewing**: Reviewer/referee for Netherlands Organisation for Scientific Research (NWO), Italian National Agency for the Evaluation of Universities and Research Institutes (ANVUR)

2021– **Prize referee:** Referee for national & international prizes for New Zealand Mathematical Society, Australian Mathematical Socity

2015– **ARC assessments**: Reviewed many applications for grants under Australian Research Council funding schemes.

2011– **Mathematical reviews**: Reviewed many papers for international reviewing services *Mathematical Reviews* and *Zentralblatt Math*.

2007– **Peer review**: Reviewed papers for journals and conference proceedings including

- *Transactions of the American Mathematical Society*
- *Geometry & Topology*
- *Quantum Topology*
- *Electronic Journal of Combinatorics*
- *Journal of Symplectic Geometry*
- *Compositio Mathematica*
- *Algebraic & Geometric Topology*
- *Geometriae Dedicata*
- *Differential Geometry and its Applications*
- *Journal of Knot Theory & Its Ramifications*
- MFCS conference series on *Mathematical Foundations of Computer Science*
- *Advances in Geometry*
- *Discrete Applied Mathematics*
- *Formal Power Series and Algebraic Combinatorics* conference
- *Pacific Journal of Mathematics*
- *Bulletin of the Australian Mathematical Society*

Conference, seminar organisation

2023 **AustMS special session**: Organiser, with D. Crowley and P. Hekmati, of Special Session on Topology at the annual Australian Mathematical Society Meeting.

2021 **Knot Days**: Together with J. Purcell and S. Tillmann, organised a week-long virtual summer school for postgraduate students, featuring lectures, problem sessions and accessible research talks.

2020– **Australian Geometric Topology Webinar**: Together with J. Licata, J. Purcell and S. Tillmann, organising and chairing weekly Australia-wide seminars via zoom.

2019 **AustMS meeting**: Organising childcare arrangements to ensure best practices for gender equity at this large annual conference.

2016– **Monash topology seminar**: Involved in organisation and administration of Monash topology seminar, with J. Purcell, N. Do, J. Howie and others.

2015–16 **Moduli spaces seminar**: Organiser, with P. Norbury and N. Do, of Moduli Spaces seminar at University of Melbourne.

2014 **ANZMC special session**: Organiser, with C. Hodgson and N. Hoffman, of Special Session on Geometry and Topology at 8th Australia–New Zealand Mathematics Convention

2000–04 **Melbourne University Mathematics Society**: A student society. President in 2001. Organised many events, including seminars for undergraduate students.

Secondary education

2021– **Co-author, VCE Specialist Maths texts**: Joining team of authors of the leading secondary mathematics textbook in Victoria, for the most advanced secondary school mathematics course, Specialist Mathematics Units 3/4.

2012–15 **TIMES project**: 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.

10/15 **Professional development for secondary teachers**: Talk to secondary teachers, "Senior activities in the Australian Mathematical Olympiad programme", Scotch College

Mathematical Olympiad

2015– **Intermediate Problems Committee, Australian Mathematical Olympiad**: Set problems for Australian Intermediate Mathematical Olympiad competitions.

2001– **Senior Problems Committee, Australian Mathematical Olympiad**: Set problems for senior Australian mathematical Olympiad competitions, including Australian Mathematical Olympiad and AMOC Senior Contest.

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

Mathematical art

2013 **Mathematical sculpture**: 3-D printed mathematical scultpure with H. Segerman "Open book decomposition"

Advocacy / legal

07/2021 Moderator, Monash Faculty of Science Early Career Research Seminar, *Balancing caring responsibilities with academic work*

03/2016 Science Meets Parliament

07/2015 Admitted to the legal profession in Victoria

Outreach talks

11/23 ANZAAS (Australia and New Zelaand Association for the Advancement of Science) Science Talks, *Topology: The Shape of Space*

11/22 STELR (Science and Technology Education Leveraging Relevance) Shape Your Future Series, *Geometry, Topology and the love of maths*, online talk

05/22 International Women in Mathematics Day talk, hosted by Monash School of Mathematics Equity Committee, *"The beauty of mathematics shows itself to patient followers": the work of Maryam Mirzakhani*

08/21 MATRIX Institute, Introductory talk for Screening of Science Week documentary on Maryam Mirzakhani, "Secrets of the surface"

07/21 Moderator for Monash University Faculty of Science seminar on Caring Responsibilities

08/20 Monash University Open Day, *"Mathematics and the Shape of Space"*

09/19 LunchMaths, Monash University, *"I liked doing what I wasn't supposed to do": The life and mathematics of Karen Uhlenbeck*

12/17 Australian Mathematical Society Debate, AustMS Meeting, Macquarie University

08/17 LunchMaths, Monash University, *"The beauty of mathematics shows itself to patient followers": the work of Maryam Mirzakhani*

11/16 Ivanhoe Grammar, *About Mathematics*

09/16 LunchMaths, Monash University, *Bertrand Russell and his paradox*

09/16 The Laborastory, *Bertrand Russell*

08/16 Tall Poppy Experience, Quantum Victoria, *Mathematics – Topology: The Shape of Space*

08/15 LunchMaths, Monash University, *Your calculator as a weapon*

08/15 Tall Poppy Experience, Quantum Victoria, *Topology: The Shape of Space*

07/15 Presbyterian Ladies College, *Mathematics – Topology*

07/15 Genazzano FCJ College, *STEMSGEN: Being a mathematician*

07/15 Monash Inspiration Day, *Geometry and Topology: The Shape of Space*

08/14 LunchMaths, Monash University, *Topology: Shapes of Space, and Space of Shapes*

06/14 Maths in Action Day, University of Melbourne, *Mathematical games: Hackenbush*

Recreational mathematics 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.

Popular articles / media

- Performance Targets in Academia and the Mathematical Sciences, joint with H. Dietrich, AustMS Gazette 45(3) 153–161 (2018).
- *Talking science under the Canberra Big Tent*, NTEU Advocate 23/02, June 2016
- *Riddle. Mystery. Enigma.* ABC Radiotonic, broadcast 6/11/15.
- *Every world in a grain of sand: John Nash's astonishing geometry*, The Conversation, 27/5/15
- *Paranoid defence controls could criminalise teaching encryption*, The Conversation, 19/5/15

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

Awards

2023	Monash Student Association (MSA) Teaching Award: Student Support Award
2022	Dean's Excellence in Teaching Award (Individual)
2019	Nominated — Vice-Chancellor's Award for Honours Supervision
2019	Dean's Excellence in Honours Supervision Commendation – Faculty of Science, Monash University
2015	BH Neumann Award – Australian Mathematics Trust
2014	Tall Poppy Award – Australian Institute of Policy & Science
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.
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 1998-2004: secretary, webmaster, 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

Available on request.