

Pedram Hekmati

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Research Interests

Gerbes and twisted K -theory, gauge theoretic moduli spaces and character varieties, vertex operator algebras, generalised geometry, geometric correspondences such as the caloron transform and topological T -duality.

Employment

- 2016 – University of Auckland, New Zealand
Senior Lecturer in Pure Mathematics
- 2015 – 2017 Instituto Nacional de Matemática Pura e Aplicada, Brazil
Postdoctorate of Excellence Fellowship
- 2012 – 2015 University of Adelaide, Australia
Australian Research Council DECRA Fellowship
- 2010 – 2012 University of Adelaide, Australia
Research Associate

Education

- 2006 – 2010 Royal Institute of Technology, Stockholm, Sweden
Doctor of Philosophy in Mathematical Physics
Thesis: *Abelian Extensions, Fractional Loop Groups and Quantum Fields*
Supervised by Jouko Mickelsson
- 2008 – 2009 Massachusetts Institute of Technology, Cambridge, USA
Visiting Scholar. Supervised by Victor Kac
- 2000 – 2010 Royal Institute of Technology, Stockholm, Sweden
Master of Science in Engineering Physics
- 2008 – 2009 École Polytechnique, Paris, France
Stage d'Option Supervisor: Jean-Pierre Bourguignon

Short-Term Academic Visits

- 2018 Focus Program at the Fields Institute, Visiting Researcher, June–July
- 2016/2017 University of São Paulo, ICMC, Visiting Researcher, June/March
- 2014 Hausdorff Research Institute for Mathematics, Mathematics Research Fellow, September–October
- 2013 Abdus Salam International Centre for Theoretical Physics, Visiting Researcher, August–September
- 2013 International School for Advanced Studies (SISSA), INdAM Research Fellow, July–August
- 2010 Università di Roma, La Sapienza, Department of Mathematics, Visiting Researcher, January

Publications

- 2017 Arithmetic of Singular Character Varieties and their E-polynomials, (with David Baraglia)
Proceedings of the London Mathematical Society, **114** (2017) pp. 293–33
- 2016 Moduli Spaces of Contact Instantons, (with David Baraglia)
Advances in Mathematics, **294** (2016) pp. 562–595
- Projective Families of Dirac Operators on a Banach Lie Groupoid, (with Jouko Mickelsson)
Journal of Noncommutative Geometry, **10** (2016) pp. 1–28
- 2015 A Fourier-Mukai Approach to K -theory of Compact Lie Groups, (with David Baraglia)
Advances in Mathematics, **269** (2015) pp. 335–345
- A Geometric Model for Odd Differential K -theory, (with Michael Murray, Vincent Schlegel and Raymond Vozzo), *Differential Geometry and its Applications*, **40** (2015) pp. 123–158
- Transitive Courant Algebroids, String Structures and T-duality, (with David Baraglia)
Advances in Theoretical and Mathematical Physics, **19** 3 (2015) pp. 613–672
- 2013 The Faddeev-Mickelsson-Shatashvili Anomaly and Lifting Bundle Gerbes, (with Michael Murray, Danny Stevenson and Raymond Vozzo), *Communications in Mathematical Physics*, **319** 2 (2013), pp. 379–393
- 2012 T-duality of Current Algebras and their Quantization, (with Varghese Mathai)
Contemporary Mathematics, AMS **584** (2012), pp. 17–38
- The General Caloron Correspondence, (with Michael Murray and Raymond Vozzo)
Journal of Geometry and Physics, **62** (2012), pp. 224–241
- 2011 Calculus Structure on the Lie Conformal Algebra Complex and the Variational Complex, (with Alberto De Sole and Victor Kac), *Journal of Mathematical Physics*, **52** (2011), 35 pages
- 2010 Fractional Loop Groups and Twisted K -theory, (with Jouko Mickelsson)
Communications in Mathematical Physics, **299** 3 (2010), pp. 741–763
- Integrability Criterion for Abelian Extensions of Lie Groups,
Proceedings of the American Mathematical Society, **138** 11 (2010), pp. 4137–4148

Submitted

- 2018 A Foliated Hitchin–Kobayashi Correspondence (with David Baraglia),
42 pages, [arXiv:1802.09699](https://arxiv.org/abs/1802.09699)
- 2016 Real Bundle Gerbes, Orientifolds and Twisted KR -Homology, (with Michael Murray, Richard Szabo and Raymond Vozzo), 44 pages, [arXiv:1608.06466](https://arxiv.org/abs/1608.06466)

Research Grants

- 2018 – 2020 Marsden Faststart Grant (with D. Baraglia),
Exploiting Gauge Theory and Duality in Geometry, \$345,000
- 2018 – 2020 Australian Research Council Discovery Project (with M. Murray, R. Vozzo, D. Stevenson,
D. Evans), *Twisted K-theory, Operator Algebras and Higher Geometry*, \$416,557
- 2017 – 2018 FRDF Faculty Grant, *Symmetries and Quantum Theory: A New Synthesis*, \$30,000
- 2017 PBRF Research Grant, \$5,000
- 2014 ECMS Faculty Research Grant, *New Applications of Gauge Theory to Geometry*, \$16,500
- 2013 – 2015 Australian Research Council Discovery Project, (with M. Murray),
Geometric Transforms and Duality, \$315,000
- 2012 – 2014 Australian Research Council Discovery Early Career Researcher Award (DECRA),
Group Actions and K-theory: A New Direction, \$375,000
- 2010, 2011 OCLS Faculty Research Grant, \$4,000
- 2010 Category 1 Faculty Research Grant, \$6,000
- 2008, 2008 Alice and Knut Wallenberg Foundation Travel Grant, \$2,000
- 2007 Royal Swedish Academy of Sciences Research Grant, \$3,000

Conference Funding

- 2017 PBRF funding for *Conformal and Symplectic Geometry* (with R. Gover), \$5,000
NZMS funding for graduate students, \$1,000
- 2010 – 2015 AMSI and AustMS funding for seven separate IGA conferences at the University of Adelaide,
2017 total approx. \$70,000

Appointments, Fellowships and Awards

- 2018 Deputy Chair of the Australian and New Zealand Association of Mathematical Physics
- 2016 Member of the NSF funded research network *Geometric Structures and Representation Varieties*
- 2014 Research Fellowship at the Hausdorff Research Institute for Mathematics
- 2013 ICTP Mathematics Research Fellowship
- 2013 INdAM Research Fellowship from the Italian Research Council
- 2011, 2012 Head of School's Award for Lecturing and Tutoring Excellence
- 2003 Sandviken Award for Outstanding Academic Merit
- 2003 Anna Whitlock Fellowship for Overseas Studies
- 2000 Rotary Club Award for Outstanding Academic Merit

Selected Invited Conference Talks

- 2018 Geometric Quantization and Applications, *CIRM, Luminy*, October
Index Theory and Applications to Positive Scalar Curvature and Related Areas, *University of Adelaide*, June
- 2017 Third Pacific Rim Mathematical Association Congress, *Oaxaca*, August
Mathematical Congress of the Americas, *McGill University*, July
Loop Spaces, Supersymmetry and Index Theory, *Chern Institute*, July
 K -theory, Subfactors and Conformal Field Theory, *Isaac Newton Institute, Cambridge*, June
 T/U -dualities and Generalized Geometry, *University of Zagreb*, June
- 2016 II Brazilian Meeting for Young in Pure and Applied Mathematics, *Campinas*, December
The Latin American Congress of Mathematicians, *Barranquilla*, July
Gromov-Witten theory, Gauge Theory and Dualities, *Australian National University*, January
- 2015 First Brazil-Spain Joint Meeting in Mathematics, *Fortaleza*, December
Interactions between Geometry and Physics, *São Paulo*, August
Infinite-Dimensional Structures in Higher Geometry and Representation Theory, *University of Hamburg*, Feb.
- 2014 Positive Curvature and Index Theory, *National University of Singapore*, November
Quantum Physics and Noncommutative Geometry, *Hausdorff Research Institute for Mathematics*, September
Poisson 2014, *University of Illinois at Urbana-Champaign*, August
String Geometry and Loop Spaces, *University of Greifswald*, July
- 2013 Representation Theory in Geometry, Topology and Combinatorics, *University of Melbourne*, November
Geometry of Strings and Fields, *The Galileo Galilei Institute for Theoretical Physics*, August
Moduli Spaces and Mathematical Physics, *CIMAT, Guanajuato*, January

A complete list is available at <http://pedram.hekmati.se/>

Student Supervision

PhD Students

- 2018 – Olivia Sorto, (co-supervised with R. Gover)
2017 – Daniel Snell, (co-supervised with R. Gover)
2016 – Bartek Ewertowski, (co-supervised with R. Gover)

MPhil Students

- 2012 – Vincent Schlegel, MPhil Student (co-supervised with M. Murray),
2013 *The Caloron Correspondence and Odd Differential K-theory*

Honours Students

- 2018 David Farrell, Honours Student, *Fibre Bundles and Einstein Metrics*
2018 Louis Christie, Honours Student, *Morse Theory and Witten Deformation*
2013 Thi Quynh Trang Nguyen, Honours Student (co-supervised with D. Baraglia)
Einstein Metrics on Principal Circle Bundles
2011 Adrián Fernandez Tojo, Honours Student (co-supervised with M. Varghese),
Birkhoff Factorisation Applied to Holomorphic Bundles

Summer Research Students

2013 Parsa Kavkani, *Integer Partitions and Young Diagrams*

2012 Thi Quynh Trang Nguyen, *Geometric Aspects of Yang-Mills Theory*

Teaching

University of Auckland

2019 Calculus, Semester 1, Lecturer and Tutor

Linear Algebra, Semester 2, Lecturer and Tutor

Lie Groups and Lie Algebras, Semester 2, Lecturer

2018 Analysis on Manifolds and Differential Geometry, Semester 2, Lecturer

Advancing Mathematics 1: Calculus, Semester 2, Lecturer and Tutor

Functional Analysis, Semester 2, Lecturer

Advancing Mathematics 2: Calculus, Semester 2, Lecturer and Tutor

2017 Advancing Mathematics 2: Calculus, Semester 2, Lecturer and Tutor

Advancing Mathematics 2: Calculus, Semester 2, Lecturer and Tutor

IMPA / University of Queensland

2016 Index Theory, Advanced Graduate Course at IMPA, Lecturer

2015 K-theory and its Applications, Mini-Course at the AMSI Winter School in Brisbane, Lecturer

University of Adelaide

2015 Mathematics for Information Technology I: Probability Theory, Semester 1, Lecturer and Tutor

2014 Mathematics for Information Technology I: Discrete Mathematics, Semester 1, Lecturer and Tutor

Algebraic Topology, Semester 1, Lecturer and Tutor

2013 Mathematics IA: Calculus, Semester 1, Lecturer and Tutor

2012 Integration and Analysis III, Semester 2, Lecturer and Tutor

Mathematics IB: Calculus, Semester 1, Lecturer and Tutor

2011 Topics in Analysis IV, Semester 2, Lecturer and Tutor

Introduction to Financial Mathematics I, Semester 1, Lecturer and Tutor

Royal Institute of Technology

2009 Advanced Quantum Mechanics, Undergraduate Course, Semester 2, Teaching Assistant

2009 Vector Calculus, Undergraduate Course, Semester 2, Teaching Assistant

2009 Thermodynamics, Undergraduate Course, Semester 2, Teaching Assistant

2008 Relativity Theory, Undergraduate Course, Semester 2, Lecturer and Teaching Assistant

2007 Relativity Theory, Undergraduate Course, Semester 2, Teaching Assistant

Academic Service

- Managing Guest-Editor of the Special Issue *String Geometries, Dualities and Topological Matter*, for Elsevier's Journal of Geometry and Physics in 2017.
- Member of the Student Prize, Research, and the 120/130 Course Implementation Committees.
- Reviewer for the AMS Mathematical Reviews and Zentralblatt MATH.
- Assessor for the Australian Research Council's Discovery Project Scheme.
- Referee for *Duke Mathematical Journal*, *Advances in Mathematics*, *Documenta Mathematica*, *International Mathematics Research Notices*, *Proceedings of the American Mathematical Society*, *Mathematische Nachrichten*, *Journal of Topology and Analysis*, *International Journal of Mathematics*, *Journal of Geometry and Physics*, *Journal of the Australian Mathematical Society*, *Contemporary Mathematics*, *Vietnam Journal of Mathematics* and *Journal of Mathematical Physics*.

Seminar Organisation:

- 2018 – Organiser of the *Geometry and Analysis Seminar* at the University of Auckland.
- 2017 – Co-organiser of the *Department Colloquium* at the University of Auckland.
- 2018 Organiser of a Reading Group on *Homological Algebra* at the University of Auckland.
- 2010 Organiser of the *Strings Journal Club* at the University of Adelaide (3 years).
- 2009 Organiser of a Reading Group in *Mathematical Physics* at MIT.

Conference and Workshop Organisation

- 2019 Co-organiser of the conference *Moduli Spaces, Representation Theory and Quantization* at RIMS, Kyoto.
- 2018 Co-organiser of the conference *Character Varieties and Topological Quantum Field Theory* in Auckland.
- Co-organiser of the conference *Conformal and Symplectic Geometry* in Auckland.
- Co-organiser of the annual *ANZAMP* conference in Auckland.
- 2017 Co-organiser of a distinguished lecture series by *Prof Frances Kirwan* in Adelaide.
- Co-organiser of a distinguished lecture series by *Prof Jørgen Ellegaard Andersen* in Adelaide.
- Co-organiser of the AMSI/IGA conference *Gauge Theory and Higher Geometry* in Adelaide.
- Organiser of a distinguished lecture series by *Dr David Baraglia* in Auckland.
- 2016 Co-organiser of the conference *String Geometries and Dualities* at IMPA, Rio de Janeiro.
- 2015 Co-organiser of the AMSI/IGA conference *Symmetries and Spinors: Interactions between Geometry and Physics* in Adelaide, featuring lectures by Prof José Figueroa-O'Farrill and Prof Maxim Zabzine.
- 2014 Organiser of an IGA lecture series by *Dr Timothy Nguyen* in Adelaide.
- 2013 Co-organiser of the IGA conference *Aspects of Finsler Geometry* in Adelaide, featuring lectures by Prof Robert Bryant.

- 2013 Co-organiser of a *Special Session in Mathematical Physics* at the 57th Annual AustMS in Sydney.
Co-organiser of the IGA conference *Current Groups and Twisted K-theory* in Adelaide, featuring a lecture series by Prof Jouko Mickelsson.
- 2012 Co-organiser of the AMSI/IGA conference *Geometry of Supermanifolds* in Adelaide, featuring a lecture series by Prof Ugo Bruzzo.
Organiser of an IGA lecture series by Dr Ittay Weiss in Adelaide.
Co-organiser of the AMSI/IGA conference *Dualities in Field Theories and the Role of K-Theory* in Adelaide, featuring a lecture series by Prof Jonathan Rosenberg.
Co-organiser of the AMSI/IGA conference *The Mathematical Implications of Gauge-String Dualities* in Adelaide, featuring a lecture series by Prof Rajesh Gopakumar.
- 2011 Co-organiser of the AMSI/IGA conference *Group-Valued Moment Maps with Applications to Mathematics and Physics* in Adelaide, featuring a lecture series by Prof Eckhard Meinrenken.
- 2010 Co-organiser of the AMSI/IGA conference *The Dirac Operators in Geometry, Topology, Representation Theory, and Physics* in Adelaide, featuring a lecture series by Prof Dan Freed.

Professional Memberships

American Mathematical Society

New Zealand and Australian Mathematical Society

International Association of Mathematical Physics

Australian and New Zealand Association of Mathematical Physics

Personal Details

Citizenships: Australia, Sweden

Languages: Swedish, Persian, English, French, Spanish