# Stephen **McCormick**

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## Education

**PhD in Mathematics** — *Monash University, Australia*
The Phase Space for the Einstein–Yang–Mills Equations, Black Hole Mechanics, and a Condition for Stationarity — *2014*

**Bachelor of Science (Honours)** — *Monash University, Australia*
Specialisation: Mathematics — *2008*

**Bachelor of Science** — *Monash University, Australia*
Specialisations: Mathematics & Physics — *2007*

## Employment

**Luleå University of Technology** — *Luleå, Sweden*
Senior Lecturer/Associate Professor (*Universitetslektor*) — *Since January 2023*

**University of Regensburg** — *Regensburg, Germany*
Researcher — *March 2022 – December 2022*

**Uppsala University** — *Uppsala, Sweden*
Researcher — *December 2019 – December 2021*
Postdoctral Research Fellow — *December 2017 – December 2019*

**KTH Royal Institute of Technology** — *Stockholm, Sweden*
Postdoctoral Research Fellow — *August 2016 – December 2017*

**University of New England** — *Armidale, Australia*
Postdoctoral Fellow — *June 2014 – June 2017*

## Research funding

**The Magnus Bergvall Foundation** — *The Magnus Bergvall Foundation*
- Project: A New Black Hole Uniqueness Theorem and Generalised Static Metrics — *2026–2028*

**The Kempe Foundation** — *The Kempe Foundation*
- Project: A New Black Hole Uniqueness Theorem and Generalised Static Metrics — *2025–2028*

**Olle Engkvist Foundation** — *Olle Engkvists Stiftelse*
- Project: On the energy of space-time — *2025–2027*

**KVA (General Mathematics Call)** — *Royal Swedish Academy of Sciences*
- Project: On a Generalisation of Static Metrics — *2025–2027*

**Stiftelsen GS Magnusons fond** — *Royal Swedish Academy of Sciences*
- Project: On the Space-Time Bartnik Mass — *2025–2027*

**The Kempe Foundation** — *The Kempe Foundation*
- Project: On the energy of space-time — *2024–2027*

**Stiftelsen GS Magnusons fond** — *Royal Swedish Academy of Sciences*
- Project: Advancing a new mass for asymptotically hyperbolic manifolds — *2024–2026*

**Australia–Germany Joint Research Cooperation Scheme** — *Universities Australia/DAAD*
- Project: On Bartnik's quasi-local mass functional
  Jointly funded with Prof. Dr. Carla Cederbaum (Tübingen) — *2016–2017*

**UNE Research Seed Grant** — *University of New England, Australia*
- Project: The Yamabe problem outside a ball and the Bartnik mass — *2015*

# Publication List

Authors are listed alphabetically with contributions considered equal.

20XX **McCormick, S.; Wolff, M.**, Extensions of spacetime Bartnik data and estimates for the Bartnik mass outside of time-symmetry, arXiv preprint arXiv:2602.13096

20XX **Dahl, M.; Kröncke, K.; McCormick, S.**, The volume-renormalized mass from a Hamiltonian perspective, arXiv preprint arXiv:2506.11841

2026 **McCormick, S.**, Mass, staticity, and a Riemannian Penrose inequality for weighted manifolds, SIGMA (to appear). (arXiv:2601.19875)

2025 **McCormick, S.**, V-static metrics and the volume-renormalised mass, J. Geom. Anal. **35**(4)

2025 **Dahl, M.; Kröncke, K.; McCormick, S.**, A volume-renormalized mass for asymptotically hyperbolic manifolds, Comm. Anal. Geom. **33**(9)

2024 **McCormick, S.**, An Overview of Bartnik's Quasi-Local Mass, Beijing J. Pure Appl. Math., **1**(2)

2024 **McCormick, S.**, Fill-ins with scalar curvature lower bounds and applications to positive mass theorems, Ann. Glob. Anal. Geom., **65**(26)

2022 **Chen, P.-N.; McCormick, S.**, Quasi-local Penrose inequalities with electric charge, Int. Math. Res. Not., **2022**(22)

2021 **Alaee, A.; Cabrera Pacheco, A. J.; McCormick, S.**, Stability of a quasi-local positive mass theorem for graphical hypersurfaces of Euclidean space, Trans. Amer. Math. Soc., **374**

2021 **McCormick, S.**, The Hilbert manifold of asymptotically flat metric extensions, Gen. Relativ. Gravit. **53**(14).

2020 **McCormick, S.**, Gluing Bartnik extensions, continuity of the Bartnik mass, and the equivalence of definitions, Pacific J. Math, **304**(2).

2019 **McCormick, S.**, On the charged Riemannian Penrose inequality with charged matter, Class. Quantum Gravity, **37**(1).

2019 **McCormick, S.; Miao, P.**, On the evolution of the spacetime Bartnik mass, Pure Appl. Math. Q. **15**(3).

2019 **McCormick, S.; Miao, P.**, On a Penrose-like inequality in dimensions less than eight, Int. Math. Res. Not., **2019**(7).

2018 **Cabrera Pacheco, A. J.; Cederbaum, C.; McCormick, S.**, Asymptotically hyperbolic extensions and an analogue of the Bartnik mass, J. Geom. Phys., **132**.

2018 **McCormick, S.**, On a Minkowski-like inequality for asymptotically flat static manifolds, Proc. Am. Math. Soc., **146**(9).

2017 **Cabrera Pacheco, A. J.; Cederbaum, C.; McCormick, S.; Miao, P.**, Asymptotically flat extensions of CMC Bartnik data, Class. Quant. Grav. **34**(10).

2017 **McCormick, S.**, The asymptotically flat scalar-flat Yamabe problem with boundary, J. Geom. Anal., **27**(3).

2015 **McCormick, S.**, A note on mass-minimising extensions, Gen. Rel. Grav. **47**(12).

2014 **McCormick S.**, First Law of Black Hole Mechanics as a Condition for Stationarity, Phys. Rev. D **90**, 104034.

2014 **McCormick S.**, The Phase Space for the Einstein-Yang-Mills Equations and the First Law of Black Hole Thermodynamics, Adv. Theor. Math. Phys. **18**(4).

## Extended research programmes

**Institut Mittag-Leffler** — *Djursholm, Sweden*
General Relativity, Geometry, and Analysis: Beyond the First 100 Years After Einstein — *September – December 2019*

**Erwin Schrödinger Institute** — *Vienna, Austria*
Geometry and Relativity Program — *July – August 2017*

**Institut Henri Poincaré** — *Paris, France*
Mathematical General Relativity Program — *September – November 2015*

**Mathematical Sciences Research Institute (MSRI)** — *Berkeley, USA*
Mathematical General Relativity Program — *November – December 2013*

## Talks

**Motivating the volume-renormalised mass and V-static metrics** — *Banff International Research Station, Banff, Canada*
Geometric Analysis on Asymptotically Hyperbolic Manifolds — *April 2026*

**An Introduction to the Volume-Renormalised Mass** — *Chennai Mathematical Institute, Chennai, India*
Connections among Spin Geometry, Minimal Surfaces and Relativity — *January 2026*

**On bounded scalar curvature fill-ins and positive mass theorems** — *KTH, Sweden*
Invited Seminar — *October 2024*

**A new mass-like invariant for asymptotically hyperbolic manifolds** — *Clark University, USA (online)*
Lefschetz Geometry & Geometric Analysis Seminar (invited) — *April 2024*

**Variational properties of the volume-renormalised mass** — *KTH, Sweden*
Invited Seminar — *March 2024*

**A volume-renormalised mass for asymptotically hyperbolic manifolds** — *Institut Mittag-Leffler, Sweden*
Einstein Spaces and Special Geometry — *July 2023*

**The Riemannian Penrose inequality with electric charge with a quasi-local perspective** — *KTH, Sweden*
Invited seminar — *October 2022*

**Gluing collars to manifolds; how and why** — *Universität Freiburg, Germany*
FHST Meeting on Geometry and Analysis — *January 2020*

**Gluing collars to manifolds; how and why** — *Institut Mittag-Leffler, Sweden*
General Relativity, Geometry, and Analysis: Beyond the First 100 Years After Einstein — *November 2019*

**Bartnik's quasi-local mass** — *CIMAT (Guanajuato), Mexico*
Mathematical Relativity: A Riemannian Approach — *May 2019*

**Some recent developments on Bartnik's quasi-local mass** — *Queen Mary University of London, UK*
Invited seminar — *March 2019*

**Some recent results pertaining to Bartnik's quasi-local mass** — *University of Miami, USA*
Invited seminar — *October 2018*

**Asymptotically hyperbolic extensions and estimates for an analogue of the Bartnik mass** — *Banff International Research Station, Canada*
Wordshop on Asymptotically Hyperbolic Manifolds — *May 2018*

**A Penrose-like inequality in dimensions less than eight** — *University of Sydney, Australia*
International Conference on PDEs, Geometric Analysis and Functional Inequalities — *March 2017*

**The first law of black hole mechanics as a condition for stationarity and staticity** — *Universität Tübingen, Germany*
Static metrics and Bartnik's quasi-local mass conjecture — *May 2016*

**Killing vectors as Lagrange multipliers** — *Monash University, Australia*
Workshop on Analysis, Geometry and Mathematical Relativity: a celebration of Robert Bartnik's 60th birthday — *February 2016*

**The Phase Space for the Einstein-Yang-Mills Equations,** — *Universität Regensburg, Germany*
Invited seminar — *October 2015*

**The First Law of Black Hole Mechanics as a Condition for Stationarity** — *ICMAT, Spain*
Invited seminar — *October 2015*

**The Phase Space for the Einstein-Yang-Mills Equations and the First Law of Black Hole Thermodynamics** — *University of New England, Australia*
Mini-Workshop on Nonlinear PDEs — *October 2014*

**The Phase Space for the Einstein-Yang-Mills Equations and the First Law of Black Hole Thermodynamics** — *University of Wollongong, Australia*
Invited seminar — *September 2014*

**The Einstein-Yang-Mills Phase Space and the First Law of Black Hole Mechanics** — *MSRI, Berkeley, USA*
Invited seminar — *November 2013*

**The First Law of Black Hole Mechanics as a Condition for Stationarity** — *University of Sydney, Australia*
57th Annual meeting of the Australian Mathematical Society — *October 2013*

**The Phase Space for the Einstein-Yang-Mills Equations and the First Law of Black Hole Thermodynamics** — *Australian National University, Australia*
Australian Mathematical Sciences Students' Conference — *July 2013*

**Linearisation Stability of the Einstein-Maxwell and Einstein-Yang-Mills Constraints on an Asymptotically Flat Manifold** — *University of Ballarat, Australia*
56th Annual meeting of the Australian Mathematical Society — *September 2012*

**Dain's Variational Principle and its Relation to an Angular Momentum-Mass Inequality in General Relativity** — *University of Wollongong*
55th Annual meeting of the Australian Mathematical Society — *September 2011*

# Miscellaneous

## Supervision

- Cosupervision of one PhD student, KTH Royal Institute of Technology (ongoing).
- Supervision of one Bachelor's thesis, Uppsala University (2020).
- Supervision of two Bachelor's projects, University of New England (2014 – 2016).

## Teacher Training

I have completed 16 credits (ECTS) of pedagogical education at LTU:

- Qualifying course in higher education pedagogy, parts 1 and 2 (7.5 credits), 2023.
- Course Design (2 credits), 2024.
- Programme Design (2 credits), 2024.
- Research Supervision Course (4.5 credits), 2024.

## Languages

**English:** First language
**Swedish:** Good working knowledge
**German:** Elementary communication

## Conference organisation

Oct. 2014 **Mini-Workshop on Nonlinear PDEs**, The University of New England, Armidale, Australia

Jul. 2013 **2nd Annual Australian Mathematical Sciences Students' Conference**, Australian National University, Canberra, Australia

Jul. 2011 **Inaugural Australian Mathematical Sciences Students' Conference***, Monash University, Melbourne, Australia

**The Australian Mathematical Sciences Students' Conference has now become a regular event.*

## Outreach

### Interview for Cosmos Magazine and associated video

Promotional piece for UNE (link: https://bit.ly/3G3re1p) *2016*

### Talk – Complicated ideas in less than 140 characters

Part of a series to get staff at UNE involved in science communication (link: https://goo.gl/8wkWHU) *2016*

### Presenter for Far Out Science at UNE

A programme for school students to be introduced to fun science *2015 – 2016*

### Multiple radio interviews

I was interviewed on ABC RN Tamworth (New England radio) on a few occasions to speak about mathematics, physics and science communication *2015 – 2016*

### Presenter for the Science Experience at Monash University

A programme for school students to be introduced to fun science (link: https://goo.gl/kNRJnH) *2012 – 2014*

## Reviewing

In recent years I have reviewed for the following journals:

**Annals of Global Analysis and Geometry**
**Beijing Journal of Pure and Applied Mathematics**
**Classical and Quantum Gravity**
**Communications in Contemporary Mathematics**
**Communications in Mathematical Physics**
**General Relativity and Gravitation**
**International Mathematics Research Notices**
**Journal of Geometric Analysis**
**Journal of Mathematical Physics**
**Letters in Mathematical Physics**
**Mathematische Nachrichten**
**SIGMA**
**Transactions of the American Mathematical Society**

## Elected positions

### National Committee for Mathematics

*Sweden*

Role: Member *February 2024 – Present*

### Faculty of Science Postgraduate Committee

*Monash University, Australia*

Role: Representative for the School of Mathematical Sciences *July 2010 – March 2014*

### Council of the Australian Mathematical Society

*Australia*

Role: Student observer *2011 – 2012*

## Expert roles

- Expert assessor for research grant application for the DFG (German Research Council) (2025).
- Mentor for British Isles Graduate Workshop V (2024).
- Special reviewer (opponent) for one licentiate thesis defence (KTH, Stockholm 2023).

## Conferences & workshops

Apr. 2026 **Geometric Analysis on Asymptotically Hyperbolic Manifolds**, Banff International Research Station, Banff, Canada

Jan. 2026 **Connections among Spin Geometry, Minimal Surfaces and Relativity**, Chennai Mathematical Institute, Chennai, India

Jun. 2025 **Boundaries, stability, and singularities in general relativity – A meeting celebrating Helmut Friedrich's 80th birthday**, Mittag-Leffler Institute, Djursholm, Sweden

July 2024 **British Isles Graduate Workshop V: Mathematical General Relativity (mentor)**, Coalport, England

July 2023 **Einstein Spaces and Special Geometry**, Mittag-Leffler Instutute, Djursholm, Sweden

May 2023 **13th Central European Relativity Seminar**, Stockholm, Sweden

Jan. 2020 **2nd FHST Meeting on Geometry and Analysis**, Freiburg, Germany

Jun. 2019 **Geometric Analysis and General Relativity: A conference in honour of Gerhard Huisken's 60th birthday**, ETH Zürich, Switzerland

May 2019 **Mathematical Relativity: A Riemannian Approach**, CIMAT (Guanajuato), Mexico

Aug. 2018 **Mathematical General Relativity**, Mathematische Forschungsinstitut Oberwolfach, Germany

May. 2018 **Asymptotically Hyperbolic Manifolds**, Banff International Research Station, Canada

Apr. 2018 **Mass in General Relativity**, Simons Center for Geometry and Physics, NY, USA

Jul. 2017 **Between Geometry and Relativity**, Erwin Schrödinger Institute, Vienna, Austria

Mar. 2017 **International Conference on PDEs, Geometric Analysis and Functional Inequalities**, University of Sydney, Australia

May 2016 **Static metrics and Bartnik's quasi-local mass conjecture**, Universität Tübingen, Germany

Feb. 2016 **Workshop on Analysis, Geometry and Mathematical Relativity: a celebration of Robert Bartnik's 60th birthday**, Monash University, Australia

Nov. 2015 **General Relativity: A Celebration of the 100th Anniversary**, Institute Henri Poincaré, France

Oct. 2015 **Dynamics of Self-Gravitating Matter**, Institute Henri Poincaré, France

Sep. 2015 **Geometric Aspects of Mathematical Relativity**, Université de Montpellier, France

Sep. 2015 **Recent Advances in General Relativity**, Institute Henri Poincaré, France

Mar. 2015 **Andrejewski Days: 100 years of General Relativity**, Brandenburg an der Havel, Germany

Oct. 2014 **Mini-Workshop on Nonlinear PDEs**, University of New England, Australia

Sep. 2014 **Mini-Workshop on Geometric Analysis**, University of Wollongong, Australia

Jul. 2014 **AMSI/AustMS Conference on Geometric Analysis and Stochastic Methods in Geometry**, University of Queensland, Australia

Nov. 2013 **Initial Data and Evolution Problems in General Relativity**, MSRI, Berkeley, CA, USA

Dec. 2012 **Trilateral Meeting on PDE and Related Topics**, University of Wollongong, Australia

Sep. 2012 **56th Annual Meeting of the Australian Mathematical Society**, University of Ballarat, Australia

Sep. 2012 **Early Career Researcher Workshop of the Australian Mathematical Society**, University of Ballarat, Australia

Sep. 2011 **55th Annual Meeting of the Australian Mathematical Society**, University of Wollongong, Australia

Sep. 2011 **Early Career Researcher Workshop of the Australian Mathematical Society**, University of Wollongong, Australia

Sep. 2011 **Geometry of Differential Equations Workshop**, Australian National University, Australia

Jun. 2011 **Australian Mathematical Sciences Students' Conference**, Monash University, Australia

Dec. 2010 **Riemannian and Differential Geometry Workshop**, Latrobe University, Australia

Sep. 2010 **54th Annual Meeting of the Australian Mathematical Society**, University of Queensland, Australia

Sep. 2010 **International Conference on "Geometric and Nonlinear Partial Differential Equations"**, Mission Beach, QLD, Australia, Hosted by the Australian National University

Jul. 2010 **Victorian Mathematical Sciences Students' Conference**, University of Melbourne, Australia

Apr. 2010 **Workshop on nonlinear PDEs**, University of Wollongong, Australia

Jan. 2010 **Workshop on General Relativity and Geometric Analysis**, Monash University, Australia