

RESEARCH INTEREST

My research interests lie in the intersection of Analysis, Geometry and Topology with possible application to Physics. I exploit tools from Index Theory, Combinatorial Topology, and Parametrised Stable Homotopy Theory to tackle challenging questions in Differential Geometry with the main focus on the spaces and moduli spaces positive scalar curvature metrics and Riemannian metrics with the exceptional holonomy group G_2 and $\text{Spin}(7)$.

RESEARCH AND WORK EXPERIENCE

Postdoctoral Researcher, University of Melbourne

Since 2024

- Conducting innovative and collaborative research on the global topology of moduli spaces of G_2 manifolds and its connection to theoretical physics
- Volunteering in teaching by assisting in lectures and organising seminars;
Cosupervising Master's students

Postdoctoral Researcher, Albert-Ludwigs Universität Freiburg

2022-2024

- Conducting innovative and collaborative research on the global topology of moduli spaces of G_2 manifolds within the Simon Collaboration “Special Holonomy in Geometry, Analysis and Physics”
- Volunteering in teaching by assisting in lectures and organising seminars;
Cosupervising Master's students

Doctoral Researcher, Georg-August Universität Göttingen

2017-2022

- Conducted collaborative research on positive scalar curvature and index theory within Project 09 “Diffeomorphisms and the Topology of Positive Scalar Curvature” of the SPP 2026 “Geometry at Infinity”
- Conducted independent research on parametrised stable homotopy theory leading to publication
- Presented complex research results on international conferences and in research seminars as invited speaker
- Training of Master students and volunteering in teaching by organising and running a seminar on the Atiyah-Patodi-Singer Index Theorem (October 2020 - February 2021)

Doctoral Researcher, Universität Augsburg

2018-2020

Research Stay, Mentor: Prof. Dr. Wolfgang Steimle

- Research Project: Isotopy Versus Concordance in Positive Scalar Curvature;
subproject of PhD thesis aiming to study positive scalar curvature metrics beyond index theory.
- Construction of a novel comparison space and a spectral sequence that measures the difference between the two concepts. (April 2018 - September 2020)
- volunteered for teaching by organising and running a seminar for bachelor and master students on simplicial sets. (April - August 2020)

Master Student, Georg-August Universität Göttingen

2017

- Computing bordism groups of classifying spaces to answer a question of Edward Witten.

EDUCATION

Ph.D in Mathematics , Georg-August Universität Göttingen, Grade: 1.0 Supervisors: Prof. Dr. Thomas Schick and Prof. Dr. Wolfgang Steimle – Thesis: “Concordances in Positive Scalar Curvature and Index Theory”	2017–2022
M.Sc. in Mathematics , Georg-August Universität Göttingen, Grade: 1.0 Supervisor: Prof. Dr. Thomas Schick – Thesis: “Pin Bordism in Low Degrees of Classifying Spaces” – Major Fields of Study: Differential Geometry and Algebraic Topology	2014–2017
B.Sc. in Mathematics , Georg-August Universität Göttingen, Grade: 1.9 Supervisor: Jun.-Prof. Dr. Henrik Seppänen – Thesis: “Bertini’s Theorem” – Major Fields of Study: Complex Analysis and Algebraic Geometry	2010–2014

ARTICLES

1. T. Hertl, “Line Bundle Twists for Unitary Bordism are Ghosts”, *Algebraic & Geometric Topology* **(25)** (2025), 2053—2066.

PREPRINTS

1. T. Hertl, “Moduli Spaces of Positive Curvature Metrics in Dimension Four and Beyond”, <https://arxiv.org/abs/2310.14115>, October 2023, accepted for publication in *Mathematische Zeitschrift*
2. D. Crowley, S. Goette, T. Hertl, “Moduli Spaces of G_2 -manifolds may not be contractible”, <https://arxiv.org/pdf/2503.15829.pdf>, March 2025

STUDENTS

- (2) Isla Lim, (co-supervision with Prof. Dr. Diarmuid Crowley)
Master Thesis March 2025 - ??
- (1) Jan-Bennet Wiskant, (co-supervision with Prof. Dr. Thomas Schick)
Master Thesis, Title: “Normal Pin[−]-bordism of classifying spaces in low degrees” Sept. 2024 - July 2025

TEACHING

- **Instructor**, The University of Melbourne
Seminar on Rational Homotopy Theory Spring 2025
- **Course Designer**, The University of Melbourne
Complex Analysis Spring 2025
- **Co-organiser**, The University of Melbourne
(jointly with Prof. Dr. Diarmuid Crowley and Prof. Dr. Marcy Robertson)
Topology Seminar Spring 2024 - Spring 2025
- **Instructor**, Albert-Ludwigs Universität Freiburg
(jointly with Dr. Jonas Schnitzer)
Seminar on Operads in Algebra, Topology, and Physics Fall 2023
- **Instructor**, Albert-Ludwigs Universität Freiburg
Proseminar on Matrix Groups Spring 2023

- **Teaching Assistant**, Albert-Ludwigs Universität Freiburg
Anaylsis III Fall 2022
- **Teaching Assistant**, Georg-August Universität Göttingen
Ordinary Differential Equations (B.Mat.0030.Mp) Fall 2021
- **Instructor**, Georg-August Universität Göttingen and Universität Augsburg
(jointly with Prof. Dr. Thomas Schick and Dr. Artem Nepechiy)
Oberseminar on the Atiyah-Patodi-Singer Index Theorem (M.Math.4914) Fall 2020
- **Instructor**, Universität Augsburg
(jointly with Prof. Dr. Wolfgang Steimle)
Seminar on Simplicial Sets. Spring 2020
- **Tutor**, Universität Augsburg
Linear Algebra I and II Fall 2019 –Spring 2020
- **Tutor**, Georg-August Universität Göttingen
Algebraic Topology I and II Fall 2016 –Spring 2017
- **Tutor**, Georg-August Universität Göttingen
Functional Analysis Spring 2016
- **Tutor**, Georg-August Universität Göttingen
Mathematical Models of Physics Fall 2015
- **Tutor**, Georg-August Universität Göttingen
Analysis II Spring 2015
- **Tutor**, Georg-August Universität Göttingen
Mathematics for Physicist Spring 2014
- **Tutor**, Georg-August Universität Göttingen
Analysis III Fall 2013

SCIENTIFIC TALKS

- (31) “ G_2 Moduli Spaces May Have Holes” December 2025
Gauge-Theory and String Geometry, Australian National University (ANU), Canberra, Australia
- (30) “ G_2 Moduli Spaces May Have Holes” July 2025
Arbeitsgruppen-Seminar Ammann, University of Regensburg, Regensburg, Germany
- (29) “ G_2 Moduli Spaces May Have Holes” July 2025
Gauge Theory Seminar, Humboldt University, Berlin, Germany
- (28) “ G_2 Moduli Spaces May Have Holes” July 2025
Oberseminar Differentialgeometrie, University of Hamburg, Hamburg, Germany
- (27) “Concordances and Bordism of Positive Scalar Curvature Metrics” June 2025
Oberseminar Differentialgeometrie, University of Freiburg, Freiburg, Germany
- (26) “ G_2 Moduli Spaces May Have Holes” June 2025
Oberseminar Geometrie und Topologie, University of Göttingen, Göttingen, Germany
- (25) “ G_2 Moduli Spaces May Have Holes” May 2025
Differential Geometry Seminar, University of Adelaide, Adelaide, Australia
- (24) “The Holonomy Groups of Symmetric Spaces” May 2025
TOPS, University of Adelaide, Adelaide, Australia
- (23) “Topological Methods in G_2 -geometry” March 2025
AIM Workshop “New directions in G_2 geometry”, AIM, Los Angeles, USA
- (22) “Moduli Spaces of Positive Curvature Metrics” March 2025

Non-commutative geometry seminar, Texas A&M, College Station, USA

- (21) “Concordances in Positive Scalar Curvature and Index Theory”
Joint Meeting of the AMS, AustMS, and NZMS, Auckland, New Zealand December 2024
- (20) “On the Global Topology of G2 Moduli Spaces”
The Geometry of Moduli Spaces in String Theory , MATRIX Institute, Creswick, Australia September 2024
- (19) “On the Global Topology of G2 Moduli Spaces”
Workshop on topology, representation theory and higher structures, Isle of Skye June 2024
- (18) “On Moduli Spaces of G2 Holonomy Metrics”
Final Simons Collaboration Meeting, Durham, North Carolina May 2024
- (17) “Moduli Spaces of Positive Curvature Metrics”
Oberseminar Differentialgeometrie, University of Augsburg May 2024
- (16) “Moduli Spaces of G_2 manifolds may have holes”
Bath Algebra, Geometry and Number Theory Seminar, University of Bath April 2024
- (15) “Moduli Spaces of G_2 Holonomy Metrics”
Bavarian Topology Meeting, University of Regensburg April 2024
- (14) “Moduli spaces of Positive Curvature Metrics”
Online Differential Geometry Seminar, YMSC Tsinghua University March 2024
- (13) “Moduli spaces of Positive Curvature Metrics”
Oberwolfach Workshop 2408 “Analysis, Geometry and Topology of Positive Scalar Curvature Metrics” February 2024
- (12) “On Homotopy Groups of (Observer) Moduli Spaces of G2 Manifolds”
ULB geometry seminar, Université libre de Bruxelles February 2024
- (11) “Moduli Spaces in Riemannian Geometry”
Annual Meeting of the German Math Society, TU Ilmenau September 2023
- (10) “Moduli Spaces of Positive Curvature Metrics”
“Developments in Modern Mathematics”, University of Goettingen September 2023
- (9) “Concordances in Positive Scalar Curvature and Index Theory”
“Seminar Differentialgeometrie und Geometrische Analysis”, HU Berlin July 2023
- (8) “Line Bundle Twists for Unitary Bordism are Ghosts”
“Topology Seminar”, University of Melbourne April 2023
- (7) “Concordances in Positive Scalar Curvature and Index Theory”
“Oberseminar Topologie”, WWU Münster November 2022
- (6) “Positive Scalar Curvature from a Concordance Viewpoint”
“Dirac Operators in Topology, Geometry, and Representation Theory”, Cortona June 2022
- (5) “Positive Scalar Curvature from a Concordance Viewpoint”
“Oberseminar Topologie”, University of Fribourg May 2022
- (4) “Cubical Approximations for Positive Scalar Curvature Metrics”
“Arbeitsgruppenseminar”, University of Regensburg December 2021
- (3) “Cubical Approximation for Positive Scalar Curvature Metrics”
DMV-ÖMV Jahrestagung 2021 - Sektion 09, Geometrie und Topologie September 2021
- (2) “Cubical Models for Positive Scalar Curvature”
“Oberseminar Geometrie”, University of Augsburg November 2020
- (1) “Cubical Approximation for Positive Scalar Curvature Metrics”
SPP 2026 - Geometry at Infinity, WWU Münster, Germany April 2019

CONFERENCES AND WORKSHOPS ATTENDED

- “Applications of Topological Data Analysis to Mathematical Biology ”
MATRIX-Institute, Creswick, Australia November 2024
- “Riemannian Topology Meeting”
Conference; Fribourg, Switzerland November 2023
- “Special Holonomy: Progress and Open Problem 2023”
Conference; Stony Brook, USA September 2023
- “Seventh Annual Meeting” of the Simons Collaboration
Conference; Simons Center, New York, USA September 2023
- “Geometric flows and related topics”
British Isles Graduate Workshop, Scotland July 2023
- “Der Umkehrssatz von Nash-Moser”
Blockseminar; Päwesin, Germany June 2023
- “Geometric Analysis”
Conference; Regensburg, Germany March 2023
- “Algebraic Geometry, Gauge Theory and the Swampland Conjectures”
Conference; Oxford, UK January 2023
- “Global Analysis on Manifolds”
Conference; Freiburg, Germany September 2022
- “Dirac Operators in Topology, Geometry, and Representation Theory”
Conference/Workshop; Cortona, Italy June 2022
- “Konvexe Integration”
Blockseminar; Kloster Frauenwörth am Chiemsee, Germany May 2022
- “Foliations, pseudodifferential operators and groupoids”
Winter School; Göttingen, Germany March 2022
- “Das Positive-Masse-Theorem”
Blockseminar; Päwesin, Germany July 2021
- “Cellular E_k -algebras”
Oberwolfachseminar; Online May 2021
- “Dirac Operatoren und Skalarkrümmung”
Blockseminar; Päwesin, Germany Oktober 2020
- “Geometry of Scalar Curvature”
Conference/Workshop; Cortona, Italy July 2019
- “Curvature and Global Shape”
Conference; Münster, Germany November 2019
- “Harmonic Maps”
Blockseminar; Srni, Czech Republic June 2018
- “Augsburg-Fribourg-Karlsruhe Riemannian Topology Meeting”
Conference; Fribourg, Switzerland November 2018
- “Young Topologist Meeting”
Conference; Copenhagen, Denmark July 2018
- “Selberg’s Trace Formula”
Blockseminar; Päwesin, Germany June 2018
- “International Conference of Manifolds, Groups, and Homotopy”
Conference; Isle of Skye, Scotland June 2018

- “On Global Differential Geometry”
Summer School and Conference; AIMS-Institute, M’Bour, Senegal May 2018
- “Lower Curvature Bounds”
Oberwolfach Seminar; Oberwolfach, Germany November 2017
- Young Topologist Meeting
Conference; Stockholm, Sweden July 2017
- “Coarse Index Theory”
Summer School; Freiburg, Germany September 2016
- “Manifolds and K-Theory”
Summer School; Freiburg, Germany July 2015

SERVICE WORK

- Reviewer for zbMATH Open since 2022
- Volunteer Open Day University of Melbourne 18th Aug 2024
- Referee for *Geometry & Topology*

PROGRAMMING LANGUAGES

- **Java:** Working experience
- **C:** Working experience
- **Python:** Familiar with
- **R:** Familiar with

LANGUAGES

- **German:** native
- **English:** C1-level (IELTS with score 8)
- **Spanish:** basic

REFERENCES

Prof. Dr. Thomas Schick
Faculty of Mathematics and Computer Science
Georg-August Universität Göttingen
thomas.schick@math.uni-goettingen.de
+49 (551) 39-27766

Prof. Dr. Sebastian Goette
Abteilung für Reine Mathematik
Albert-Ludwigs Universität Freiburg
sebastian.goette@math.uni-freiburg.de
+49 (761) 203-5571

Prof. Dr. Wolfgang Steimle
Faculty of Mathematics and Natural-Science
Universität Augsburg
wolfgang.steimle@math.uni-augsburg.de
+49 (821) 598 - 2208

Prof. Dr. Diarmuid Crowley
School of Mathematics and Statistics
The University of Melbourne
dcrowley@unimelb.edu.au
+61 3 834 44712