

# Markus Upmeier — Oct 2021

Department of Mathematics  
University of Aberdeen  
Aberdeen AB24 3UE, UK

+44 (0) 1224 272752  
markus.upmeier@abdn.ac.uk  
www.abdn.ac.uk/people/markus.upmeier

## EDUCATION

<b>PhD Mathematics</b> University of Göttingen, Germany	Sept 2013
<b>Diploma Mathematics</b> Minor in Physics, University of Göttingen, Germany	Oct 2010

## PROFESSIONAL EXPERIENCE

<b>Lecturer</b> Department of Mathematics, University of Aberdeen, UK	since 2021
<b>Stipendiary Lecturer (fixed term)</b> St Anne's & St Peter's College, University of Oxford, UK	2019–2021
<b>Simons Collaboration Researcher</b> Mathematical Institute, University of Oxford, UK	2018–2021
<b>Akademischer Rat a.Z.</b> Institut für Mathematik, University of Augsburg, Germany	2014 – 2019
<b>Postdoctoral Researcher</b> Département de Mathématique, ULB Bruxelles, Belgium	2013 – 2014

## GRANTS AND AWARDS

<b>Heisenberg Fellowship</b> (rejected in favor of a permanent position) Project <i>Quantum Invariants and Categorification in Gauge Theory</i>	502,000 €
<b>Priority Programme Geometry at Infinity</b> , 2017 – 2023 Project Leader of <i>Gerbes in Renormalization and Quantization</i>	11,400 €
<b>DFG Research Fellowship</b> , 2017 – 2018 Funding own position, <i>Interactions of Moduli Spaces, Gerbes, Elliptic Genera</i>	40,000 €
<b>Diploma honours award</b> of the University of Göttingen, 2010	
<b>Studienstiftung des deutschen Volkes</b> undergraduate scholarship, 2008 – 2010	

## RESEARCH INTERESTS

**Algebraic topology:** applications of homotopy theory to gauge theory in mathematical physics and low-dimensional topology. Cohomology operations and representation theory. Applications of topology to other branches of science.

**Index theory:** categorifications of Atiyah–Singer theory, higher orientations in gauge theory, applications to positive scalar curvature.

**Gauge theory:** quantum invariants, Floer homology. Higher dimensional gauge theory and exceptional holonomy metrics. Applications to physics.

## JOURNAL PUBLICATIONS

1. *Canonical orientations for moduli spaces of  $G_2$ -instantons with gauge group  $SU(m)$  or  $U(m)$*  (with D. Joyce),  
**J. Differential Geom.** (accepted), 2018. (13 citations)
2. *Orientation data for moduli spaces of coherent sheaves over Calabi–Yau 3-folds* (with D. Joyce),  
**Adv. Math.** 381, 2021. (9 citations)
3. *On spin structures and orientations for gauge-theoretic moduli spaces* (with D. Joyce),  
**Adv. Math.** 381, 2021. (4 citations)
4. *A categorified excision principle for elliptic symbol families*,  
**Q. J. Math.** 72, 1099–1132, 2021. (9 citations)
5. *On orientations for gauge-theoretic moduli spaces* (with D. Joyce and Y. Tanaka),  
**Adv. Math.** 362, 2020. (16 citations)
6. *Closed almost-Kähler 4-manifolds of constant non-negative Hermitian holomorphic sectional curvature are Kähler* (with M. Lejmi),  
**Tohoku Math. J.** 72, 581–594, 2020. (3 citations)
7. *Connections on central extensions, lifting gerbes, and finite-dimensional obstruction vanishing* (with I. Biswas), pp. 39–55 in *Geometry at the Frontier*,  
**Contemp. Math.** 766, AMS, Providence, RI, 2021. (1 citation)
8. *Integrability theorems and conformally constant Chern scalar curvature metrics in almost Hermitian geometry* (with M. Lejmi),  
**Commun. Anal. Geom.** 28, 1603–1645, 2020. (10 citations)
9. *Chern’s contribution to the Hopf problem: An exposition based on Bryant’s paper* (with A. Tralle),  
**Differential Geom. Appl.** 57, 138–146, 2018. (1 citation)
10. *The canonical 2-gerbe of a holomorphic vector bundle*,  
**Theory Appl. Categ.** 32, 1028–1049, 2017. (1 citation)
11. *Refinements of the Chern-Dold character: cocycle additions in differential cohomology*,  
**J. Homotopy Relat. Struct.** 11, 291–307, 2016. (3 citations)
12. *Extremal  $K$ -contact metrics* (with M. Lejmi),  
**Math. Z.** 281, 673–687, 2015.
13. *Algebraic structure and integration maps in cocycle models for differential cohomology*,  
**Algebr. Geom. Topol.** 15, 65–83, 2015. (3 + 14 citations of arXiv:1112.4173)

## Preprints

14. *Homological Lie brackets on moduli spaces and pushforward operations in twisted  $K$ -theory*, submitted to *J. Topol.*, arXiv:2101.10990, 2021.
15. *Vertex  $F$ -algebra structures on the complex oriented homology of  $H$ -spaces* (with J. Gross), submitted to *J. Pure Appl. Algebra*, 2021.
16. Book *Higher categorical index theory and applications to moduli spaces* (in preparation)

**Total citations:** 86 (source: Google Scholar)

**TEACHING EXPERIENCE****Lectures**

Complex Analysis, Aberdeen	2021
Discrete Time Models, FinTech Business School	2021
Index Theory of Elliptic Operators (20 postgraduates), TCC, Oxford	2021
Linear Algebra II (1st year, 130 students), Augsburg	2017
Geometry of Curves and Surfaces (2nd year, 100 students), Augsburg	2016
Linear Algebra I (1st year, 150 students), Augsburg	2016
Analysis II intensive course (1st year, 20 students), Göttingen	2010

**Undergraduate seminars**

Topology of Manifolds (3rd year, 15 students), Augsburg	2016
Homotopy Theory (2nd year, 10 students), Augsburg	2015

**Problem classes**

Geometry of Surfaces (3rd year, 15 students), Oxford	2019
Differentiable Manifolds (4th year, 10 students), Oxford	2018
Spin Geometry (4th year, 10 students), Augsburg	2015
Introduction to Topology (3rd year, 15 students), Augsburg	2015
Geometry of Curves and Surfaces (2nd year, 20 students), Augsburg	2014
Complex Functions II (4th year, 10 students), Göttingen	2012
Analysis II (1st year, 30 students), Göttingen	2012
Algebraic Topology II (4th year, 10 students), Göttingen	2011

**Tutorials and classes** (at St Peter's & St Anne's College, Univ. of Oxford)

Groups and Group Actions II (1st year, 11 students)	2021
Group Theory (2nd year, 5 students)	2021
Integration (2nd year, 10 students)	2021
Groups and Group Actions I (1st year, 11 students)	2021
Linear Algebra II (1st year, 11 students)	2021
Metric Spaces and Complex Analysis (2nd year, 12 students)	2020
Linear Algebra (1st year, 11 students)	2020
Number Theory (2nd year, 5 students)	2020
Analysis III (1st year, 13 students)	2020

Analysis II (1st year, 13 students)	2020
Differential Equations (2nd year, 10 students)	2019
Linear Algebra (1st year, 12 students)	2019

## STUDENT SUPERVISION

### Final year theses

D. Moskaliovaite, <i>Matrix Lie groups</i>	2021
Z. Puospekaite, <i>Representations of Lie groups</i>	2021
L. Hui, <i>Twisted K-theory</i> , now a PhD at Urbana-Champaign	2021
T. Jowitt, <i>Gerbes and projective Hilbert bundles</i>	2021
G. Cooper, <i>Spinors on Riemann surfaces</i> , now a PhD at Oxford	2020
I. Jones, <i>Applications of Index theory to Algebraic Geometry</i> Now a PhD in topological data analysis at Durham	2020
R. Pellegrin, <i>Clifford Algebras in Geometry</i> Now a master's student in Computer Vision at Cambridge	2020

### PhD co-supervision

A. Bojko, <i>Orientation data for non-compact Calabi–Yau's</i> Now a postdoc at ETH Zürich	since 2019
---	------------

### Other

C. Evans, UNIQ research internship promoting underprivileged groups Project <i>Fractals and Hyperbolic Surfaces</i>	2019
Postdoctoral mentoring for PhDs (M. Wink, G. Cooper)	since 2017

## RECENT INVITED TALKS

Gauge Theory Seminar, Regensburg, Germany	June 2021
Algebra, Geometry and Number Theory Seminar, Bath, UK	Nov 2020
Conference Yorkshire Durham Geometry Day, York, UK	Mar 2020
Seminar CUNY Graduate Center, New York, USA	Sept 2019
Oberseminar Differentialgeometrie, Freiburg, Germany	July 2019
Seminar Geometrie und Topologie, Stuttgart, Germany	July 2019
SPP Conference Geometry at Infinity, Münster, Germany	Apr 2019
Geometry & Analysis Seminar, Mathematical Institute, Oxford, UK	Jan 2019
Centre for Quantum Geometry of Moduli Spaces, Sandbjerg Gods, Denmark	Oct 2018

Simons Collaboration Special Holonomy: Progress and Open Problems, Stony Brook, USA	Sept 2018
Seminar CUNY Graduate Center, New York, USA	Sept 2018
Conference Analytic and Algebraic Geometry, ICTS Bangalore, India	Mar 2018
Workshop Informal Geometry, Valle d'Aosta, Italy	Jan 2018
CIRM Constant Scalar Curvature Metrics in Kähler and Sasaki Geometry, Luminy, France	Jan 2018
Kick-off of the Priority Programme Geometry at Infinity, Potsdam, Germany	Nov 2017
Geometry & Analysis Seminar, Mathematical Institute, Oxford, UK	Oct 2017
Analysis, Geometry and Topology of Positive Scalar Curvature Metrics, Oberwolfach, Germany	Jul 2017
Workshop Hopf 2017, University of Marburg	Mar 2017

### ORGANIZATION OF SCIENTIFIC EVENTS

Weekly research seminar <i>Geometry &amp; Analysis</i> , Univ. of Oxford	2020–2021
Graduate workshop <i>Index theory</i> (with B. Hanke)	2017
Spring school <i>Dynamical Systems in Number Theory</i> (with B. Hanke)	2015

### ACADEMIC SERVICES

Undergraduate admissions, St Anne's College, Oxford

Hiring committee for full professorship, Univ. of Augsburg

MathSciNet and zbMATH reviewer

**Journal referee:** Math. Ann., Phys. Rev. Lett., J. Homotopy Relat. Struct.,  
Geom. Topol.

### PROFESSIONAL DEVELOPMENT

ATL, Univ. of Oxford, **Associate Fellow of the Higher Education Academy** AFHEA,  
2021 (expected)

Univ. of Oxford: Writing research proposals (2018), Equality and diversity (2019)

Univ. of Augsburg: Examinations (2015), University didactics (2015), Rhetoric (2015),  
Legal foundations of teaching (2015)

## ACADEMIC REFERENCES

Professor Dominic Joyce FRS

Phone: +44 1865 273574

Email: joyce@maths.ox.ac.uk

Mathematical Institute, University of Oxford, Woodstock Road, Oxford OX2 6GG, UK

Professor Bernhard Hanke

Phone: +49 821 5982238

Email: hanke@math.uni-augsburg.de

Institut für Mathematik, Univ. Augsburg, Universitätsstr. 14, 86159 Augsburg, Germany

Professor Thomas Schick

Phone: +49 551 397766

Email: thomas.schick@math.uni-goettingen.de

Mathematisches Institut, Univ. Göttingen, Bunsenstrasse 3, 37073 Göttingen, Germany