

NICHOLAS WILLIAMS

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EDUCATION

Doctorate in Mathematics

University of Cologne
Started at University of Leicester
Supervisor: Sibylle Schroll
Summa cum laude

September 2018 – April 2022

April 2021 – April 2022

September 2018 – April 2021

Graduate Diploma in Quantitative Economics

Birkbeck, University of London
Distinction

October 2017 – June 2018

MMathPhil in Mathematics & Philosophy

Worcester College, Oxford
Double First Class Honours

October 2012 – June 2016

EMPLOYMENT

Research Associate

University of Cambridge
With Ailsa Keating

October 2024 – September 2026

Postdoctoral Research Associate

Lancaster University
With David Pauksztello

September 2022 – September 2024

JSPS Short Term Postdoctoral Research Fellow

University of Tokyo
With Osamu Iyama

May 2022 – August 2022

Graduate Teaching Assistant

King's College London

September 2021 – December 2021

Guest Teacher

London School of Economics

September 2021 – December 2021

Feedback Session Leader

University of Leicester

January 2019 – December 2020

JOURNAL PUBLICATIONS

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 9. The two higher Stasheff–Tamari orders are equal <i>Journal of the European Mathematical Society</i> | <i>To appear</i> |
| 8. Steenrod operations via higher Bruhat orders With Guillaume Laplante-Anfossi <i>Proceedings of the London Mathematical Society</i> , Volume 130, no. 2, e70024 | <i>2025</i> |
| 7. A survey of congruences and quotients of partially ordered sets <i>EMS Surveys in Mathematical Sciences</i> , Volume 11, no. 1, pp. 153–203 | <i>2024</i> |
| 6. Triangulations of prisms and preprojective algebras of type A With Osamu Iyama <i>International Mathematics Research Notices</i> , rnae059 | <i>2024</i> |

5. Stability spaces of string and band modules 2024
 With Sibylle Schroll, Aran Tattar, Hipolito Treffinger, and Yadira Valdivieso
Journal of Pure and Applied Algebra, Volume 228, no. 4, 107503
4. Quiver combinatorics and triangulations of cyclic polytopes 2023
Algebraic Combinatorics, Volume 6, no. 3, pp. 639–60
3. The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders 2023
Electronic Journal of Combinatorics, Volume 30, no. 1, P1.29
2. New interpretations of the higher Stasheff–Tamari orders 2022
Advances in Mathematics, Volume 407, 108552
1. The combinatorics of tensor products of higher Auslander algebras of type A 2021
 With Jordan McMahon
Glasgow Mathematical Journal, 63(3), pp. 526–546

PEER-REVIEWED CONFERENCE PROCEEDINGS

4. From higher Bruhat orders to Steenrod cup- i coproducts 2024
 With Guillaume Laplante-Anfossi
Proceedings of the 36th International Conference on Formal Power Series and Algebraic Combinatorics, Séminaire Lotharingien de Combinatoire 91B, Art. 10
3. The higher Stasheff–Tamari orders in representation theory 2023
Representations of Algebras and Related Structures
2. Studying triangulations of even-dimensional cyclic polytopes via directed graphs 2023
Proceedings of the 35th International Conference on Formal Power Series and Algebraic Combinatorics, Séminaire Lotharingien de Combinatoire 89B, Art. 4
1. The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders 2021
Proceedings of the 33rd International Conference on Formal Power Series and Algebraic Combinatorics, Séminaire Lotharingien de Combinatoire 85B, Art. 6

OTHER CONFERENCE PROCEEDINGS

2. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence 2024
Cluster Algebras and Its Applications
Oberwolfach Reports, No. 2/2024
1. Triangulations of cyclic polytopes and the higher Auslander algebras of type A 2022
Various issues on representation theory and related topics
RIMS Kōkyūroku, No. 2234

OTHER PUBLICATIONS

2. Microthesis: Triangulations of cyclic polytopes in representation theory 2022
London Mathematical Society Newsletter, No. 501, 33-34
1. Higher-dimensional combinatorics in representation theory 2022
 Doctoral thesis, University of Cologne

PREPRINTS

5. Oriented matroids and type A cluster categories 2025
 arXiv:2509.07883
4. Preorders on maximal chains: 2025
 hyperplane arrangements, Cambrian lattices, and maximal green sequences
 With Mikhail Gorsky
 arXiv:2506.08858

3. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence 2024
 With Omar Kidwai
 arXiv:2401.10093
2. A geometric perspective on the τ -cluster morphism category 2023
 With Sibylle Schroll, Aran Tattar, and Hipolito Treffinger
 arXiv:2302.12217
1. A structural view of maximal green sequences 2023
 With Mikhail Gorsky
 arXiv:2301.08681

PRIZES AND SCHOLARSHIPS

- Gibbs prize for Mathematics & Philosophy** 2016
 University of Oxford
 For top performance in Mathematics papers
- Gibbs prize for Mathematics & Philosophy** 2015
 University of Oxford
 For top performance in Mathematics papers
- Academic scholarship** 2013
 Worcester College, Oxford

INVITED CONFERENCE TALKS (IN PERSON)

- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** May 2024
Algebraic Geometry Days in Glasgow
 University of Glasgow
- Triangulations of cyclic polytopes through the lens of reconfiguration** August 2023
Minisymposium on Combinatorial Reconfiguration
International Congress on Industrial and Applied Mathematics
 Waseda University, Tokyo
- A structural view of maximal green sequences** June 2023
Cluster structures in the North
 University of Central Lancashire
- A structural approach to maximal green sequences** September 2022
Silting theory, algebras and representations
 Charles University, Prague

INVITED CONFERENCE TALKS (VIRTUAL)

- An algebraic interpretation of the higher Stasheff–Tamari orders** November 2020
International Conference on Representations of Algebras
 Selected to give talk by scientific committee based on research snapshot

CONTRIBUTED CONFERENCE TALKS (IN PERSON)

- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** August 2024
International Conference on Representations of Algebras
 Shanghai Jiao Tong University
- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** February 2024
Clusters and their Applications in the North
 University of Glasgow

Donaldson–Thomas invariants for the Bridgeland–Smith correspondence *January 2024*

Cluster Algebras and Its Applications

Mathematisches Forschungsinstitut Oberwolfach

Triangulations of prisms and preprojective algebras of type A *July 2023*

Combinatorial representation theory in Leeds

University of Leeds

A structural view of maximal green sequences *April 2023*

Maurice Auslander Distinguished Lectures and International Conference

Woods Hole, Massachusetts

Cyclic polytopes and representation theory *December 2022*

Representation theory of algebras session

Canadian Mathematical Society Winter Meeting, Toronto

Algebraic interpretation of the higher Stasheff–Tamari orders *July 2022*

Various issues on representation theory and related topics

Research Institute for Mathematical Sciences, Kyoto University

Higher analogues of Grassmannian clusters *April 2019*

Maurice Auslander Distinguished Lectures and International Conference

Woods Hole, Massachusetts

Higher analogues of Grassmannian clusters *April 2019*

New Connections and Directions in Representation Theory

University of Leeds

Higher analogues of Grassmannian clusters *April 2019*

Tropical Geometry meets Representation Theory

University of Leicester

CONTRIBUTED CONFERENCE TALKS (VIRTUAL)

The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders *January 2022*

Formal Power Series and Algebraic Combinatorics

Bar-Ilan University

SEMINAR TALKS (IN PERSON)

Steenrod operations via higher Bruhat orders *December 2024*

Algebra, Number Theory, Logic and Representation theory seminar

University of East Anglia

Donaldson–Thomas invariants for the Bridgeland–Smith correspondence *October 2024*

Algebraic Geometry Seminar

University of Cambridge

Donaldson–Thomas invariants for the Bridgeland–Smith correspondence *June 2024*

Geometric, Algebraic, and Physical structures around the moduli of Meromorphic

Quadratic Differentials

Simons Center for Geometry and Physics

Stony Brook University

Donaldson–Thomas invariants for the Bridgeland–Smith correspondence *April 2024*

Leeds Algebra Seminar

University of Leeds

- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** *April 2024*
Algebra and Number Theory Seminar
University of Vienna
- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** *March 2024*
Paris Algebra Seminar
Institut de Mathématiques de Jussieu-Paris Rive Gauche
- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** *October 2023*
Sheffield Geometry and Physics seminar
University of Sheffield
- Donaldson–Thomas invariants for the Bridgeland–Smith correspondence** *October 2023*
EGRET seminar
University of Edinburgh
- Donaldson–Thomas theory of quivers with potential** *September 2023*
Exact Asymptotics Theoretical Sciences Visiting Program
Okinawa Institute of Science and Technology
- Higher-dimensional cluster combinatorics and representation theory** *August 2023*
OIST Representation Theory Seminar
Okinawa Institute of Science and Technology
- Combinatorics of KP solitons** *August 2023*
Exact Asymptotics Theoretical Sciences Visiting Program
Okinawa Institute of Science and Technology
- A structural view of maximal green sequences** *February 2023*
Algebra Group Seminar
University of Cologne
- The higher Stasheff–Tamari orders on triangulations of cyclic polytopes** *November 2022*
Séminaire du LaCIM
Université du Québec à Montréal
- Cyclic polytopes and representation theory** *November 2022*
Geometry and Mathematical Physics Seminar
University of Birmingham
- Cyclic polytopes and representation theory** *October 2022*
Pure Mathematics Seminar
Lancaster University
- Mutation in higher cluster categories** *October 2022*
Seminar@Aarhus
Aarhus University
- Equivalence of maximal green sequences** *April 2022*
Working Seminar in Algebra and Geometry
University of Cologne
- Equivalence of maximal green sequences** *February 2022*
Paris Algebra Seminar
Institut de Mathématiques de Jussieu-Paris Rive Gauche
- An algebraic interpretation of the higher Stasheff–Tamari orders** *November 2019*
Pure Mathematics Seminar
University of East Anglia

SEMINAR TALKS (VIRTUAL)

Steenrod operations via higher Bruhat orders

May 2025

Longitudinal Algebra & Geometry Open Online Seminar (LAGOON)

Oriented matroids from cluster-tilting objects in type A cluster categories *March 2025*

New Directions in Group Theory & Triangulated Categories

Donaldson–Thomas invariants for the barbell quiver with potential

June 2024

Cologne algebra seminar

University of Cologne

Mutating cluster-tilting objects in $(d+2)$ -angulated cluster categories

June 2022

FD seminar

An algebraic interpretation of the higher Stasheff–Tamari orders

January 2022

Aachen–Bochum–Cologne Darstellungstheorie Seminar

RWTH Aachen University, Ruhr-University Bochum, and University of Cologne

Cyclic polytopes and higher Auslander–Reiten theory

December 2021

Tokyo–Nagoya algebra seminar

University of Tokyo and Nagoya University

The two higher Stasheff–Tamari orders are equal

May 2021

Working seminar in algebra and geometry

University of Cologne

The higher Stasheff–Tamari orders in representation theory

April 2021

Paris algebra seminar

Institut de Mathématiques de Jussieu-Paris Rive Gauche

New interpretations of the higher Stasheff–Tamari orders

March 2021

Diskrete Mathematik / Geometrie Forschungsseminar

TU Berlin

LECTURE SERIES (IN PERSON)

**Introduction to Donaldson–Thomas theory
for quivers with potential**

October 2023 – February 2024

Lancaster University

12 lectures

LECTURE SERIES (VIRTUAL)

Cyclic polytopes and higher Auslander–Reiten theory

June – July 2022

Tokyo–Nagoya algebra seminar

University of Tokyo and Nagoya University

3 lectures

POSTERS

- From higher Bruhat orders to Steenrod cup- i coproducts** *July 2024*
Formal Power Series and Algebraic Combinatorics
Ruhr-Universität Bochum
- Studying triangulations of even-dimensional cyclic polytopes via directed graphs** *July 2023*
Formal Power Series and Algebraic Combinatorics
University of California, Davis
- An algebraic interpretation of the higher Stasheff–Tamari orders** *June 2021*
Young Researchers in Mathematics
Online
Winner of 1st prize in poster competition
- An algebraic interpretation of the higher Stasheff–Tamari orders** *May 2021*
Advances in Representation Theory of Algebras
Online
- New interpretations of the higher Stasheff–Tamari orders** *January 2021*
Combinatorial algebra meets algebraic combinatorics
Université du Québec à Montréal
Online
- An algebraic interpretation of the higher Stasheff–Tamari orders** *November 2020*
International Conference on Representations of Algebras
“Research snapshot”
Online
- New interpretations of the higher Stasheff–Tamari orders** *September 2020*
Virtual Heidelberg Laureate Forum
Online
- Representation theory and Grassmannians** *March 2019*
STEM for Britain
Poster competition at UK Parliament

GRANTS AND AWARDS

- London Mathematical Society Scheme 1 *October 2023*
Conference grants
Silting, simple-minded, and stability
Co-organised with Raquel Coelho Simões and David Pauksztello
GBP 4,000
- Japan Society for the Promotion of Science *December 2021*
Short Term Postdoctoral Research Fellowship
JPY 5,384,000
12 months awarded but 3 months taken
- London Mathematical Society Scheme 8 *April 2020*
Postgraduate research conference grants
Categorifications in Representation Theory
Co-organised with Aran Tattar
GBP 2,500

ORGANISATION

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| <i>Simple-mindedness, silting, and stability</i> Co-organising with Raquel Coelho Simões and David Pauksztello Ambleside Campus, University of Cumbria | <i>July 2024</i> |
| <i>Köln Algebra and Representation Theory seminar</i> Co-organised with Daniel Schaefer University of Cologne Online | <i>April 2021 – May 2022</i> |
| <i>Categorifications in Representation Theory</i> Co-organised with Aran Tattar Online | <i>September 2020</i> |
| <i>Mathematics PhD seminar</i> University of Leicester | <i>September 2019 – August 2020</i> |
| <i>Interactions between Representation Theory and Homological Mirror Symmetry</i> Local organising committee University of Leicester | <i>May 2019</i> |

RESEARCH STAYS

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| Simons Center for Geometry and Physics Stony Brook University <i>Geometric, Algebraic, and Physical structures around the moduli of Meromorphic Quadratic Differentials</i> Invited participant 2 weeks | <i>June 2024</i> |
| University of Copenhagen Visiting: Guillaume Laplante-Anfossi Host: Nathalie Wahl 1 week | <i>January 2024</i> |
| Okinawa Institute of Science and Technology <i>Exact Asymptotics: From Fluid Dynamics to Quantum Geometry</i> Theoretical Sciences Visiting Program Invited participant 2 months | <i>August – October 2023</i> |
| Université du Québec à Montréal Visiting: Hugh Thomas 2 weeks | <i>November 2022</i> |
| University of Aarhus Visiting: Raphael Bennett-Tennenhaus and Amit Shah 1 week | <i>October 2022</i> |
| University of Cologne Visiting: Sibylle Schroll and Aran Tattar 1 week | <i>April 2021</i> |

Isaac Newton Institute for Mathematical Sciences
University of Cambridge
Cluster algebras and representation theory
Invited participant
1 week

December 2021

University of Graz
Visiting: Jordan McMahon
Host: Karin Baur
1 week

April 2019

REFEREEING

Algebraic Geometry and Physics, Annals of Representation Theory, Communications in Algebra, Compositio Mathematica, Discrete Mathematics (x2), Electronic Journal of Combinatorics, Electronic Research Archive, Indagationes Mathematicae, Journal of Algebra, Journal of Algebraic Combinatorics, Selecta Mathematica

JSPS Short Term Pre/Postdoctoral Fellowships (x7)

Quick opinions: Inventiones Mathematicae

REVIEWING

AMS MathSciNet
11 reviews written

October 2022 – present

zbMATH
14 reviews written

September 2020 – present

TEACHING

Part IB Groups, Rings, and Modules
Lecture cover: 1 lecture
University of Cambridge

February 2025

Part II Algebraic Geometry
Supervisor
University of Cambridge

January 2025 – March 2025

Real analysis
Class teacher (online)
King's College London

September 2021 – December 2021

MA107: Quantitative methods
Class teacher
London School of Economics

September 2021 – December 2021

Calculus & analysis
Class teacher (online)
University of Leicester

October 2020 – December 2020

Second-year algebra
Class teacher
University of Leicester

January 2020 – April 2020

Calculus & analysis
Class teacher
University of Leicester

October 2019 – April 2020

Elements of number theory

Class teacher

University of Leicester

*October 2019 – December 2019***Calculus & analysis**

Class teacher

University of Leicester

*January 2019 – March 2019***STUDENT SUPERVISION**

Cambridge Summer Research in Mathematics

*2025*Project: *Combinatorics of KP solitons*

Students: Lilian Contius, Chris Yuzhen Yang

COMMITTEE ROLES

Mathematics & Philosophy Representative

2015 – 2016

Joint Consultative Committee with Undergraduates

University of Oxford

Undergraduate Representative

2015 – 2016

Joint Committee for Mathematics and Philosophy

University of Oxford

Undergraduate Representative

2015 – 2016

Mathematics Department Art Committee

University of Oxford

OUTREACH

University of Leicester Representative

*November 2018, 2019, 2020**Research in the UK afternoon*

University of Cambridge

Student Helper

*March 2013, 2014, 2015**Oxford and Cambridge Student Conferences***MEMBERSHIPS**

London Mathematical Society*June 2019 – present*

Associate member

3 reports on conferences written for the LMS newsletter

Trinity College Postdoctoral Society*January 2025 – present***OTHER**

Programming

Python, Sage, Maple, node.js, Haskell

Git

L^AT_EX**Languages**

(CEFR levels)

English Native

French B1

German B1

Japanese B1