

# NICHOLAS WILLIAMS

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## EDUCATION

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### 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

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### 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

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

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

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## 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

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## 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

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## 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

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## PREPRINTS

5. Oriented matroids and type  $\mathbb{A}$  cluster categories 2025  
[arXiv:2509.07883](https://arxiv.org/abs/2509.07883)
4. Preorders on maximal chains: 2025  
hyperplane arrangements, Cambrian lattices, and maximal green sequences  
With Mikhail Gorsky  
[arXiv:2506.08858](https://arxiv.org/abs/2506.08858)

3. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence 2024  
With Omar Kidwai  
[arXiv:2401.10093](https://arxiv.org/abs/2401.10093)
2. A geometric perspective on the  $\tau$ -cluster morphism category 2023  
With Sibylle Schroll, Aran Tattar, and Hipolito Treffinger  
[arXiv:2302.12217](https://arxiv.org/abs/2302.12217)
1. A structural view of maximal green sequences 2023  
With Mikhail Gorsky  
[arXiv:2301.08681](https://arxiv.org/abs/2301.08681)

## PRIZES AND SCHOLARSHIPS

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- 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)

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- 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)

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- 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)

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- 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)

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**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)

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**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

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## SEMINAR TALKS (VIRTUAL)

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<b>Oriented matroids and maximal green sequences of type A cluster algebras</b> Combinatorics and Representation Theory seminar Korea Institute for Advanced Study	<i>October 2025</i>
<b>Steenrod operations via higher Bruhat orders</b> Longitudinal Algebra & Geometry Open Online Seminar (LAGOON)	<i>May 2025</i>
<b>Oriented matroids from cluster-tilting objects in type A cluster categories</b> New Directions in Group Theory & Triangulated Categories	<i>March 2025</i>
<b>Donaldson–Thomas invariants for the barbell quiver with potential</b> Cologne algebra seminar University of Cologne	<i>June 2024</i>
<b>Mutating cluster-tilting objects in <math>(d+2)</math>-angulated cluster categories</b> FD seminar	<i>June 2022</i>
<b>An algebraic interpretation of the higher Stasheff–Tamari orders</b> Aachen–Bochum–Cologne Darstellungstheorie Seminar RWTH Aachen University, Ruhr-University Bochum, and University of Cologne	<i>January 2022</i>
<b>Cyclic polytopes and higher Auslander–Reiten theory</b> Tokyo–Nagoya algebra seminar University of Tokyo and Nagoya University	<i>December 2021</i>
<b>The two higher Stasheff–Tamari orders are equal</b> Working seminar in algebra and geometry University of Cologne	<i>May 2021</i>
<b>The higher Stasheff–Tamari orders in representation theory</b> Paris algebra seminar Institut de Mathématiques de Jussieu-Paris Rive Gauche	<i>April 2021</i>
<b>New interpretations of the higher Stasheff–Tamari orders</b> Diskrete Mathematik / Geometrie Forschungsseminar TU Berlin	<i>March 2021</i>

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## LECTURE SERIES (IN PERSON)

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<b>Introduction to Donaldson–Thomas theory for quivers with potential</b> Lancaster University 12 lectures	<i>October 2023 – February 2024</i>
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## LECTURE SERIES (VIRTUAL)

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<b>Cyclic polytopes and higher Auslander–Reiten theory</b> Tokyo–Nagoya algebra seminar University of Tokyo and Nagoya University 3 lectures	<i>June – July 2022</i>
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## POSTERS

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

## GRANTS AND AWARDS

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

## ORGANISATION

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*Simple-mindedness, silting, and stability*

*July 2024*

Co-organising with Raquel Coelho Simões and David Pauksztello

Ambleside Campus, University of Cumbria

*Köln Algebra and Representation Theory seminar*

*April 2021 – May 2022*

Co-organised with Daniel Schaefer

University of Cologne

Online

*Categorifications in Representation Theory*

*September 2020*

Co-organised with Aran Tattar

Online

*Mathematics PhD seminar*

*September 2019 – August 2020*

University of Leicester

*Interactions between Representation Theory  
and Homological Mirror Symmetry*

*May 2019*

Local organising committee

University of Leicester

## RESEARCH STAYS

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Simons Center for Geometry and Physics

*June 2024*

Stony Brook University

*Geometric, Algebraic, and Physical structures around the moduli of Meromorphic  
Quadratic Differentials*

Invited participant

2 weeks

University of Copenhagen

*January 2024*

Visiting: Guillaume Laplante-Anfossi

Host: Nathalie Wahl

1 week

Okinawa Institute of Science and Technology

*August – October 2023*

*Exact Asymptotics: From Fluid Dynamics to Quantum Geometry*

Theoretical Sciences Visiting Program

Invited participant

2 months

Université du Québec à Montréal

*November 2022*

Visiting: Hugh Thomas

2 weeks

University of Aarhus

*October 2022*

Visiting: Raphael Bennett-Tennenhaus and Amit Shah

1 week

University of Cologne

*April 2021*

Visiting: Sibylle Schroll and Aran Tattar

1 week

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

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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, Proceedings of the Edinburgh Mathematical Society

## REVIEWING

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AMS MathSciNet October 2022 – present  
13 reviews written

zbMATH September 2020 – present  
15 reviews written

## TEACHING

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**Part III Commutative Algebra** October 2025 – July 2026  
Lecturer for 24-lecture course taken by ~50 students  
Other duties: teaching problem sheet classes and setting examination  
University of Cambridge

**Part IB Groups, Rings, and Modules** February 2025  
Lecture cover: 1 lecture  
University of Cambridge

**Part IB Groups, Rings, and Modules** February 2025  
Lecture cover: 1 lecture  
University of Cambridge

**Part II Algebraic Geometry** January 2025 – March 2025  
Supervisor  
University of Cambridge

**Real analysis** September 2021 – December 2021  
Class teacher (online)  
King's College London

**MA107: Quantitative methods** September 2021 – December 2021  
Class teacher  
London School of Economics

**Calculus & analysis** October 2020 – December 2020  
Class teacher (online)  
University of Leicester

<b>Second-year algebra</b>	<i>January 2020 – April 2020</i>
Class teacher	
University of Leicester	
<b>Calculus &amp; analysis</b>	<i>October 2019 – April 2020</i>
Class teacher	
University of Leicester	
<b>Elements of number theory</b>	<i>October 2019 – December 2019</i>
Class teacher	
University of Leicester	
<b>Calculus &amp; analysis</b>	<i>January 2019 – March 2019</i>
Class teacher	
University of Leicester	

## STUDENT SUPERVISION

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Cambridge Summer Research in Mathematics *2025*  
 Project: *Combinatorics of KP solitons*  
 Students: Lilian Contius, Chris Yuzhen Yang

## COMMITTEE ROLES

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Mathematics & Philosophy Representative	<i>2015 – 2016</i>
Joint Consultative Committee with Undergraduates	
University of Oxford	
Undergraduate Representative	<i>2015 – 2016</i>
Joint Committee for Mathematics and Philosophy	
University of Oxford	
Undergraduate Representative	<i>2015 – 2016</i>
Mathematics Department Art Committee	
University of Oxford	

## OUTREACH

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University of Leicester Representative	<i>November 2018, 2019, 2020</i>
<i>Research in the UK afternoon</i>	
University of Cambridge	
Student Helper	<i>March 2013, 2014, 2015</i>
<i>Oxford and Cambridge Student Conferences</i>	

## MEMBERSHIPS

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<b>London Mathematical Society</b>	<i>June 2019 – present</i>
Associate member	
3 reports on conferences written for the LMS newsletter	
<b>Trinity College Postdoctoral Society</b>	<i>January 2025 – present</i>

## OTHER

<b>Programming</b>	Python, Sage, Maple, node.js, Haskell Git $\text{\LaTeX}$
<b>Languages</b>	(CEFR levels)
English	Native
French	B1
German	B1
Japanese	B1