

# 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<br><i>Journal of the European Mathematical Society</i>   | <i>To appear</i> |
| 8. Steenrod operations via higher Bruhat orders<br>With Guillaume Laplante-Anfossi<br><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<br><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 $A$<br>With Osamu Iyama<br><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

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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

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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

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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

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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  $\tau$ -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

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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

**SEMINAR TALKS (VIRTUAL)**

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**Oriented matroids and maximal green sequences of type A cluster algebras** *October 2025*

Combinatorics and Representation Theory seminar

Korea Institute for Advanced Study

**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)**

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**Introduction to Donaldson–Thomas theory for quivers with potential** *October 2023 – February 2024*

Lancaster University

12 lectures

**LECTURE SERIES (VIRTUAL)**

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**Cyclic polytopes and higher Auslander–Reiten theory** *June – July 2022*

Tokyo–Nagoya algebra seminar

University of Tokyo and Nagoya University

3 lectures

## POSTERS

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- 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 1<sup>st</sup> 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

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- 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

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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

## REVIEWING

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AMS MathSciNet  
13 reviews written

*October 2022 – present*

zbMATH  
14 reviews written

*September 2020 – present*

## TEACHING

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**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**

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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 &amp; 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**

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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**

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**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**

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**Programming**

Python, Sage, Maple, node.js, Haskell

Git

L<sup>A</sup>T<sub>E</sub>X**Languages**

(CEFR levels)

English Native

French B1

German B1

Japanese B1