

# 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. Steenrod operations via higher Bruhat orders<br>With Guillaume Laplante-Anfossi<br><i>Proceedings of the London Mathematical Society</i>           | <i>To appear</i> |
| 8. The two higher Stasheff–Tamari orders are equal<br><i>Journal of the European Mathematical Society</i>   | <i>To appear</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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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

<b>A structural view of maximal green sequences</b> <i>Maurice Auslander Distinguished Lectures and International Conference</i> Woods Hole, Massachusetts	<i>April 2023</i>
<b>Cyclic polytopes and representation theory</b> <i>Representation theory of algebras session</i> Canadian Mathematical Society Winter Meeting, Toronto	<i>December 2022</i>
<b>Algebraic interpretation of the higher Stasheff–Tamari orders</b> <i>Various issues on representation theory and related topics</i> Research Institute for Mathematical Sciences, Kyoto University	<i>July 2022</i>
<b>Higher analogues of Grassmannian clusters</b> <i>Maurice Auslander Distinguished Lectures and International Conference</i> Woods Hole, Massachusetts	<i>April 2019</i>
<b>Higher analogues of Grassmannian clusters</b> <i>New Connections and Directions in Representation Theory</i> University of Leeds	<i>April 2019</i>
<b>Higher analogues of Grassmannian clusters</b> <i>Tropical Geometry meets Representation Theory</i> University of Leicester	<i>April 2019</i>

## CONTRIBUTED CONFERENCE TALKS (VIRTUAL)

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<b>The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders</b> <i>Formal Power Series and Algebraic Combinatorics</i> Bar-Ilan University	<i>January 2022</i>
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## SEMINAR TALKS (IN PERSON)

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<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Algebraic Geometry Seminar University of Cambridge	<i>October 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Geometric, Algebraic, and Physical structures around the moduli of Meromorphic Quadratic Differentials Simons Center for Geometry and Physics Stony Brook University	<i>June 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Leeds Algebra Seminar University of Leeds	<i>April 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Algebra and Number Theory Seminar University of Vienna	<i>April 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Paris Algebra Seminar Institut de Mathématiques de Jussieu-Paris Rive Gauche	<i>March 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> Sheffield Geometry and Physics seminar University of Sheffield	<i>October 2023</i>

**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

**Higher analogues of Grassmannian clusters**

*April 2019*

Algebra and Number Theory Seminar

University of Graz

## SEMINAR TALKS (VIRTUAL)

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**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

<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>

## 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-<math>i</math> 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>

**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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*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**May 2019**and Homological Mirror Symmetry*

Local organising committee

University of Leicester

## 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 <i>Cluster algebras and representation theory</i> Invited participant 1 week	<i>December 2021</i>
University of Graz Visiting: Jordan McMahon Host: Karin Baur 1 week	<i>April 2019</i>

## REFEREEING

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

JSPS Short Term Pre/Postdoctoral Fellowships

## REVIEWING

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AMS MathSciNet 8 reviews written	<i>October 2022 – present</i>
zbMATH 14 reviews written	<i>September 2020 – present</i>



## TEACHING

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### **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*

## COMMITTEE ROLES

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Mathematics & Philosophy Representative  
Joint Consultative Committee with Undergraduates  
University of Oxford

*2015 – 2016*

Undergraduate Representative  
Joint Committee for Mathematics and Philosophy  
University of Oxford

*2015 – 2016*

Undergraduate Representative  
Mathematics Department Art Committee  
University of Oxford

*2015 – 2016*

## OUTREACH

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University of Leicester Representative  
*Research in the UK afternoon*  
University of Cambridge

*November 2018, 2019, 2020*

Student Helper  
*Oxford and Cambridge Student Conferences*

*March 2013, 2014, 2015*

## OTHER

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London Mathematical Society  
Associate member  
3 reports on conferences written for the LMS newsletter

*June 2019 – present*

<b>Programming</b>	Python, Sage, Maple, node.js, Haskell Git L <sup>A</sup> T <sub>E</sub> X
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<b>Languages</b>	(CEFR levels)
English	Native
French	B1
German	B1
Japanese	B1