

# 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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### Postdoctoral Research Associate

Lancaster University

With David Pauksztello

*September 2022 – June 2025*

### 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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|---|------------------|
| 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<br>With Sibylle Schroll, Aran Tattar, Hipolito Treffinger, and Yadira Valdivieso<br><i>Journal of Pure and Applied Algebra</i> , Volume 228, no. 4, 107503 | <i>2024</i>      |
| 4. Quiver combinatorics and triangulations of cyclic polytopes<br><i>Algebraic Combinatorics</i> , Volume 6, no. 3, pp. 639–60  | <i>2023</i>      |
| 3. The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders<br><i>Electronic Journal of Combinatorics</i> , Volume 30, no. 1, P1.29  | <i>2023</i>      |

2. New interpretations of the higher Stasheff–Tamari orders  
*Advances in Mathematics*, Volume 407, 108552

2022
1. The combinatorics of tensor products of higher Auslander algebras of type  $A$   
 With Jordan McMahon  
*Glasgow Mathematical Journal*, 63(3), pp. 526–546

2021

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## PEER-REVIEWED CONFERENCE PROCEEDINGS

4. From higher Bruhat orders to Steenrod cup- $i$  coproducts  
*Proceedings of the 36th International Conference on Formal Power Series and Algebraic Combinatorics*

To appear
3. The higher Stasheff–Tamari orders in representation theory  
*Representations of Algebras and Related Structures*

2023
2. Studying triangulations of even-dimensional cyclic polytopes via directed graphs  
*Proceedings of the 35th International Conference on Formal Power Series and Algebraic Combinatorics, Séminaire Lotharingien de Combinatoire* 89B, Art. 4

2023
1. The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders  
*Proceedings of the 33rd International Conference on Formal Power Series and Algebraic Combinatorics, Séminaire Lotharingien de Combinatoire* 85B, Art. 6

2021

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## OTHER CONFERENCE PROCEEDINGS

2. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence  
*Cluster Algebras and Its Applications Oberwolfach Reports*, No. 2/2024

2024
1. Triangulations of cyclic polytopes and the higher Auslander algebras of type  $A$   
*Various issues on representation theory and related topics RIMS Kōkyūroku*, No. 2234

2022

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## OTHER PUBLICATIONS

2. Microthesis: Triangulations of cyclic polytopes in representation theory  
*London Mathematical Society Newsletter*, No. 501, 33–34

2022
1. Higher-dimensional combinatorics in representation theory  
 Doctoral thesis, University of Cologne

2022

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## PREPRINTS

4. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence  
 With Omar Kidwai  
 arXiv:2401.10093

2024
3. Steenrod operations via higher Bruhat orders  
 With Guillaume Laplante-Anfossi  
 arXiv:2309.16481

2023
2. A geometric perspective on the  $\tau$ -cluster morphism category  
 With Sibylle Schroll, Aran Tattar, and Hipolito Treffinger  
 arXiv:2302.12217

2023
1. A structural view of maximal green sequences  
 With Mikhail Gorsky  
 arXiv:2301.08681

2023

## PRIZES AND SCHOLARSHIPS

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<b>Gibbs prize for Mathematics &amp; Philosophy</b> University of Oxford For top performance in Mathematics papers	<i>2016</i>
<b>Gibbs prize for Mathematics &amp; Philosophy</b> University of Oxford For top performance in Mathematics papers	<i>2015</i>
<b>Academic scholarship</b> Worcester College, Oxford	<i>2013</i>
<b>Honorary scholarship</b> Westminster School	<i>2007</i>

## INVITED CONFERENCE TALKS (IN PERSON)

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

## INVITED CONFERENCE TALKS (VIRTUAL)

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<b>An algebraic interpretation of the higher Stasheff–Tamari orders</b> <i>International Conference on Representations of Algebras</i> Selected to give talk by scientific committee based on research snapshot	<i>November 2020</i>
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## CONTRIBUTED CONFERENCE TALKS (IN PERSON)

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<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> <i>Clusters and their Applications in the North</i> University of Glasgow	<i>February 2024</i>
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> <i>Cluster Algebras and Its Applications</i> Mathematisches Forschungsinstitut Oberwolfach	<i>January 2024</i>
<b>Triangulations of prisms and preprojective algebras of type <math>A</math></b> <i>Combinatorial representation theory in Leeds</i> University of Leeds	<i>July 2023</i>
<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>

**Cyclic polytopes and representation theory**  
*Representation theory of algebras session*  
Canadian Mathematical Society Winter Meeting, Toronto

*December 2022*

**Algebraic interpretation of the higher Stasheff–Tamari orders**  
*Various issues on representation theory and related topics*  
Research Institute for Mathematical Sciences, Kyoto University

*July 2022*

**Higher analogues of Grassmannian clusters**  
*Maurice Auslander Distinguished Lectures and International Conference*  
Woods Hole, Massachusetts

*April 2019*

**Higher analogues of Grassmannian clusters**  
*New Connections and Directions in Representation Theory*  
University of Leeds

*April 2019*

**Higher analogues of Grassmannian clusters**  
*Tropical Geometry meets Representation Theory*  
University of Leicester

*April 2019*

## CONTRIBUTED CONFERENCE TALKS (VIRTUAL)

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**The first higher Stasheff–Tamari orders are quotients of the higher Bruhat orders**  
*Formal Power Series and Algebraic Combinatorics*  
Bar-Ilan University

*January 2022*

## SEMINAR TALKS (IN PERSON)

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**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
Leeds Algebra Seminar  
University of Leeds

*April 2024*

**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
Algebra and Number Theory Seminar  
University of Vienna

*April 2024*

**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
Paris Algebra Seminar  
Institut de Mathématiques de Jussieu-Paris Rive Gauche

*March 2024*

**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
Sheffield Geometry and Physics seminar  
University of Sheffield

*October 2023*

**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
EGRET seminar  
University of Edinburgh

*October 2023*

**Donaldson–Thomas theory of quivers with potential**  
Exact Asymptotics Theoretical Sciences Visiting Program  
Okinawa Institute of Science and Technology

*September 2023*

**Higher-dimensional cluster combinatorics and representation theory**  
OIST Representation Theory Seminar  
Okinawa Institute of Science and Technology

*August 2023*

**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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**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

## 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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**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  
Short Term Postdoctoral Research Fellowship  
JPY 5,384,000  
12 months awarded but 3 months taken

December 2021

London Mathematical Society Scheme 8  
Postgraduate research conference grants  
*Categorifications in Representation Theory*  
Co-organised with Aran Tattar  
GBP 2,500

April 2020

## ORGANISATION

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*Simple-mindedness, silting, and stability*  
Co-organising with Raquel Coelho Simões and David Pauksztello  
Ambleside Campus, University of Cumbria

July 2024

*Köln Algebra and Representation Theory seminar*  
Co-organised with Daniel Schaefer  
University of Cologne  
Online

April 2021 – May 2022

*Categorifications in Representation Theory*  
Co-organised with Aran Tattar  
Online

September 2020

*Mathematics PhD seminar*  
University of Leicester

September 2019 – August 2020

*Interactions between Representation Theory  
and Homological Mirror Symmetry*  
Local organising committee  
University of Leicester

May 2019

## RESEARCH STAYS

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Simons Center for Geometry and Physics  
Stony Brook University  
*Geometric, Algebraic, and Physical structures around the moduli of Meromorphic Quadratic Differentials*  
Invited participant  
2 weeks

June 2024

University of Copenhagen  
Visiting: Guillaume Laplante-Anfossi  
Host: Nathalie Wahl  
1 week

January 2024

Okinawa Institute of Science and Technology  
*Exact Asymptotics: From Fluid Dynamics to Quantum Geometry*  
Theoretical Sciences Visiting Program  
Invited participant  
2 months

August – October 2023

Université du Québec à Montréal  
Visiting: Hugh Thomas  
2 weeks

November 2022

University of Aarhus  
Visiting: Raphael Bennett-Tennenhaus and Amit Shah  
1 week

*October 2022*

University of Cologne  
Visiting: Sibylle Schroll and Aran Tattar  
1 week

*April 2021*

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, Communications in Algebra, Discrete Mathematics, Electronic Research Archive, Journal of Algebra, Journal of Algebraic Combinatorics

## REVIEWING

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AMS MathSciNet  
7 reviews written

*October 2022 – present*

zbMATH  
13 reviews written

*September 2020 – present*

## 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 *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*

## OTHER

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London Mathematical Society *June 2019 – present*  
Associate member  
3 reports on conferences written for the LMS newsletter

**Programming**      Python, Sage, Maple, node.js, Haskell  
                              Git  
                               $\text{\LaTeX}$

**Languages**

	(CEFR levels)
English	Native
French	B1
German	B1
Japanese	B1