

# 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 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

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

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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

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## 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

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## PREPRINTS

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4. Donaldson–Thomas invariants for the Bridgeland–Smith correspondence 2024  
 With Omar Kidwai  
[arXiv:2401.10093](https://arxiv.org/abs/2401.10093)
3. Steenrod operations via higher Bruhat orders 2023  
 With Guillaume Laplante-Anfossi  
[arXiv:2309.16481](https://arxiv.org/abs/2309.16481)
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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<b>Gibbs prize for Mathematics &amp; Philosophy</b> University of Oxford For top performance in Mathematics papers	2016
<b>Gibbs prize for Mathematics &amp; Philosophy</b> University of Oxford For top performance in Mathematics papers	2015
<b>Academic scholarship</b> Worcester College, Oxford	2013
<b>Honorary scholarship</b> Westminster School	2007

## 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	May 2024
<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	August 2023
<b>A structural view of maximal green sequences</b> <i>Cluster structures in the North</i> University of Central Lancashire	June 2023
<b>A structural approach to maximal green sequences</b> <i>Silting theory, algebras and representations</i> Charles University, Prague	September 2022

## 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	November 2020
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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	February 2024
<b>Donaldson–Thomas invariants for the Bridgeland–Smith correspondence</b> <i>Cluster Algebras and Its Applications</i> Mathematisches Forschungsinstitut Oberwolfach	January 2024
<b>Triangulations of prisms and preprojective algebras of type <math>A</math></b> <i>Combinatorial representation theory in Leeds</i> University of Leeds	July 2023
<b>A structural view of maximal green sequences</b> <i>Maurice Auslander Distinguished Lectures and International Conference</i> Woods Hole, Massachusetts	April 2023

**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 barbell quiver with potential**  
Cologne algebra seminar  
University of Cologne

*June 2024*

**Donaldson–Thomas invariants for the Bridgeland–Smith correspondence**  
Geometric, Algebraic, and Physical structures around the moduli of Meromorphic Quadratic Differentials  
Simons Center for Geometry and Physics  
Stony Brook University

*June 2024*

**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** *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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**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

<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>
<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>

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 *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  
*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  
8 reviews written

*October 2022 – present*

zbMATH  
14 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***October 2019 – April 2020*

Class teacher

University of Leicester

**Elements of number theory***October 2019 – December 2019*

Class teacher

University of Leicester

**Calculus & analysis***January 2019 – March 2019*

Class teacher

University of Leicester

**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***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

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

(CEFR levels)

English Native

French B1

German B1

Japanese B1