

# PETER PHELAN

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## OBJECTIVE

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I have a lifelong passion for Mathematics and my ambition is to pursue a research-focused academic career in this field. My primary areas of interest are Homological Algebra and Commutative Algebra. Currently, I am undertaking a PhD in Mathematics at The National University of Ireland Galway, wherein I aim to identify families of binomial edge ideals for which their corresponding minimal free resolutions admit a multiplicative structure, and hence form differential graded algebras (DGA).

## EDUCATION

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### PhD (SPS) Mathematics

*October 2019 - Present*

NUI Galway, University Road, Galway, Ireland.  
School of Mathematics, Statistics and Applied Mathematics.

### Bachelor of Arts, Mathematics

*September 2015 - June 2019*

Trinity College, College Green, Dublin 2. Ireland.

Final Grade: 2.1

Sophister Modules Include:

Algebraic Topology, Commutative Algebra, Algebraic Geometry, Gröbner Bases, Functional Programming, Galois Theory, Lie Algebras, Group Representations, Differential Geometry.

## PROJECTS

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### Laplacians for Truncated Lie Algebras - Computations and Conjectures

*Supervised by Prof. Vladimir Dotsenko at Trinity College Dublin* *September 2018 - April 2019*

This project was completed as part of a final year undergraduate project.

- Investigated the homology theory of truncated special linear Lie algebras, with the purpose of deepening understanding of the Strong Macdonald Conjecture.
- Employed the Laplacian method to simplify and compute the homology of these algebras. The consequent computations agreed with the Strong Macdonald Conjecture.
- Developed Haskell code to implement the Laplacian method and to compute eigenvalues and generating functions of eigenvalues arising from the Laplacian matrix.
- Posed original conjectures pertaining to the nature of these eigenvalues and generating functions, supported by the computational data.
- Compiled research and data into a thesis-style report using LaTeX. Delivered seminar and poster presentation on the findings. This was done for each project listed here.

### Counting Dimensions of Tangent Spaces to Hilbert Schemes of Points

*Supervised by Prof. Vladimir Dotsenko at Trinity College Dublin* *June 2018 - August 2018*

This project was completed collaboratively while undertaking a summer research internship.

- Studied the Young diagram method used to prove smoothness of Hilbert schemes of points in 2 dimensions. Expanded this method to the case of Hilbert schemes of points in 3 dimensions and nested Hilbert Schemes of points in 2 dimensions.
- Proved that whenever the region between two diagrams at a point of a nested scheme is rectangular, the corresponding point is smooth. Formulated a counter example to exhibit that this condition is sufficient but not necessary.
- Proved that whenever the horizontal layers of a Young diagram at a point of a three dimensional scheme are rectangular, the corresponding point is smooth.

## The Category of Quasi-Parabolic Coherent Sheaves

Supervised by Prof. Sergey Mozgovoy at Trinity College Dublin

June 2017 - August 2017

This project was completed collaboratively while undertaking a summer research internship.

- Investigated the construction of an abelian envelope of the category of quasi-parabolic vector bundles, and the extension of quasi-parabolic vector bundles to the category of quasi-parabolic coherent sheaves.
- Proved that these two approaches yield equivalent categories. This result was already known but not stated in the literature.

## WORK EXPERIENCE

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### Undergraduate Tutor

January 2020 - April 2020

*NUI Galway*

- Prepared and delivered tutorials in complex analysis and field theory to undergraduate mathematics students.
- Managed general queries and responded to mathematical questions posed by the students.
- Assisted with student assessment by invigilating and correcting examinations.

### Support for Undergraduate Mathematics and Statistics

January 2020 - April 2020

*NUI Galway*

- Attended a tutor-training workshop on supporting learning in mathematics, placing emphasis on effective listening skills and development of a student's mathematical ability.
- Provided guidance to undergraduate students through one-on-one tuition, aiming to progress independent learning and advance mathematical literacy.
- Reflected on personal experiences as a tutor through weekly reports to further develop teaching skills.

## ACADEMIC EXPERIENCE

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### Participation in Seminar Programme

January 2020 - Present

*NUI Galway*

- Attended research-focused academic seminars in mathematics held at NUIG and participated in active discussions on the material.
- Attended a number of mathematical conferences, such as The SIAM Conference held at NUIG, The Warwick Macaulay2 Workshop and The Fellowship of the Ring Weekly Commutative Algebra Seminars, both held online.
- Reviewed and critically analysed the content discussed through written reports.

### Participation in Journal Club Programme

January 2020 - April 2020

*NUI Galway*

- Attended postgraduate-run seminars in mathematics and participated in active discussions on the material.
- Delivered presentations on personal research interests and responded to questions posed by other students.

## SKILLS AND ACHIEVEMENTS

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Awarded Hamilton Trust Summer Internship fund in 2017 and in 2018.

Haskell Programming	Macaulay2 Software	LaTeX	MS Office
Academic Writing	Academic Presentation	Collaboration	Tutoring
Problem Solving	Critical Thinking	Abstract Thinking	Communication