Hao Zhang

School of Mathematics and Statistics
University of Glasgow, United Kingdom

Email: h.zhang.4@research.gla.ac.uk
Personal Website: haozhangmath.github.io

Education

University of Glasgow

- Ph.D. in Mathematics, Expected Graduation: August 2025
- Supervisor: Prof. Michael Wemyss
- Thesis: Local forms for the double A_n quiver and Gopakumar–Vafa invariants

Nankai University

- M.S. in Mathematics
- Supervisor: Prof. Ming Ding
- Dissertation: Ring-theoretic properties of generalized cluster algebras

Beijing University of Posts and Telecommunications

- B.E. in Computer Science and Technology

Research Interests

I am an algebraic geometer investigating geometric objects through commutative and noncommutative algebra. More precisely, I am interested in resolutions of singularities, deformation theory, curve invariants and their representation theory.

Publications and Preprints

1. **Local forms for the double A_n quiver**. (arXiv:2412.10042).

   Abstract: This paper studies the noncommutative singularity theory of the double A_n quiver Q_n (with a single loop at each vertex), with applications to algebraic geometry and representation theory. We give various intrinsic definitions of a Type A potential on Q_n, then via coordinate changes we (1) prove a monomialization result that expresses these potentials in a particularly nice form, (2) prove that Type A potentials precisely correspond to crepant resolutions of cA_n singularities, (3) solve the Realisation Conjecture of Brown–Wemyss in this setting.

2. **Gopakumar–Vafa invariants of crepant resolutions of cA_n singularities**. (arXiv:2504.03139).

   Abstract: This paper describes Gopakumar–Vafa (GV) invariants associated to cA_n singularities. We (1) generalize GV invariants to crepant partial resolutions of cA_n singularities, (2) show that generalized GV invariants also satisfy Toda's formula and are determined by their associated contraction algebra, (3) give filtration structures on the parameter space of contraction algebras associated to cA_n crepant resolutions with respect to generalized GV invariants, and (4) numerically constrain the possible tuples of GV invariants that can arise. We further give all the tuples that arise from GV invariants of cA_2 crepant resolutions.

[1] Updated April 7, 2025

Talks given

1. *Gopakumar–Vafa invariants associated to cA_n singularities.* Algebraic Geometry Group Discussion, University of Glasgow, 2024.
2. *Curve intersections of crepant resolutions of cDV singularities.* Computational Algebraic Geometry Workshop, University of Durham, 2024.
3. *Local forms for the double A_n quiver.* Algebraic Geometry Group Discussion, University of Glasgow, 2023.

Teaching experience

1. Marking undergraduate assignments, Nankai University, 2019.

Conferences attended

1. Enumerative Algebraic Geometry en LibertÉ, Birmingham, 2025
2. Winter School, Lancaster, 2024
3. Computational Algebraic Geometry Workshop, Durham, 2024
4. Recent Developments in Noncommutative Algebraic Geometry, Berkeley, 2024
5. Winter School, Warwick, 2023
6. Derived Categories, Moduli Spaces, and Counting Invariants, London, 2023
7. Quivers, Clusters, Moduli and Stability, Oxford, 2023
8. Noncommutative shapes, Antwerp, 2022
9. Mirror symmetry for Looijenga interiors and beyond, online, 2022
10. E-RNG Glasgow Meeting, Glasgow, 2022
11. Hochschild (co-)homology of differential graded categories, online, 2021
12. K3 categories and hyperkähler moduli spaces, online, 2021
13. Summer School on Derived and Triangulated Categories, online, 2021