

Loïc Bramley

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Research Interests

I am currently working on the representation theory of meromorphic braided tensor categories of line operators in the holomorphic-topological twist of 4d $N=2$ theories and connections to cohomological Hall algebras [1].

Previously, I worked on non-perturbative aspects of 2d $N=(2,2)$ theories, leveraging their quantum spectral geometry together with an exact WKB analysis to determine non-perturbative partition functions and their full wall-crossing structure [2].

More broadly, I am interested in topological, holomorphic and supersymmetric quantum theories in various dimensions, their non-perturbative aspects, algebras of local operators, categories of extended operators and boundary conditions, algebraic and geometric structures of BPS states, meromorphic quantum groups, (geometric) representation theory, mirror symmetry and the BV formalism.

Education

PhD Mathematics 2023-

Heriot-Watt University, Maxwell Institute for Mathematical Sciences (MI)

- Supervisors: Lotte Hollands and Tudor Dimofte
- Expected thesis submission: 2027

MMathPhys Mathematical & Theoretical Physics 2021-2022

University of Oxford, Pembroke College

- **Distinction**

BA Physics 2017-2021

University of Oxford, Pembroke College

- **First Class**

Publications

[1] **L. Bramley**, T. Dimofte, “The 4d geometry of BPS algebras”, *in preparation*

[2] **L. Bramley**, L. Hollands, S. Murugesan, “Les Houches lectures on non-perturbative Seiberg-Witten geometry”, arXiv:2503.21742, *to be published in SciPost Physics Lecture Notes*

Talks

Hodge Club: *Line Operators and Representation Theory*, University of Edinburgh (UoE), Dec. 12, 2025

GRIFT Seminar: *The Physics of Khovanov Homology and the Skein Lasagna (Bucatini) Module*, MI, Oct. 28, 2025

GRIFT Seminar: *Line Operators in 4d HT-Twisted Theories*, MI, May 13, 2025

STAMP Seminar: *What Is a Twist of a Supersymmetric Field Theory?*, UoE, Apr. 24, 2025

Quantum Groups and Quantum Cohomology Reading Group: *Gromov-Witten Invariants and Quantum Cohomology*, UoE, Mar. 20, 2025

GRIFT Seminar: *Faddeev-Popov, BRST, BV and Back*, MI, Apr. 16, 2024

GlaMS Example Showcase: *Seiberg-Witten Theory: 4d N=2 Pure SU(2) Super Yang-Mills*, MI, Mar. 1, 2024

GRIFT Seminar: *An Introduction to Equivariant Cohomology*, MI, Sep. 26, 2023

Schools and Conferences

Holomorphic-Topological Field Theories and Representation Theory, Perimeter Institute, Nov. 3 to Nov. 7, 2025

Cluster Algebras and Mathematical Physics (CAMP) in the Lakes Summer School, University of Cumbria Ambleside Campus, Jul. 14 to Jul. 18, 2025

Enumerative Geometry and Geometric Representation Theory Summer School, University of Pisa, Jun. 23 to Jul. 4, 2025

Geometry and Physics of Mirror Symmetry, University of Sheffield, Sep. 2 to Sep. 6, 2024

Les Houches School on Quantum Geometry (Mathematical Methods for Gravity, Gauge Theories and Non-Perturbative Physics), Jul. 29 to Aug. 24, 2024

Categorical Symmetries in Quantum Field Theory Summer School, ICMS in Edinburgh, Jun. 10 to Jun. 14, 2024

Higgs Centre School of Theoretical Physics on generalised symmetries and anomalies, UoE, May 27 to May 31, 2024

Awards and Scholarships

EPSRC DTP Studentship, 2023-2027

Pembroke College Scholarship for students performing at first class level, awarded annually, 2018-2021

Best Part A Individual Presentation, *The Topology of Surfaces*, Pembroke College, 2019

Teaching

Teaching Assistant, Heriot-Watt University, F18PA Number Theory, 2025

- Tutorial planning, tutorial lecturing and marking