

# Christopher Elliott

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## Contact Details

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## Employment

2022–                Visiting Assistant Professor, **Amherst College**

2019–2022        Visiting Assistant Professor, **University of Massachusetts, Amherst**

2016–2019        Postdoctoral Fellow, **Institut des Hautes Études Scientifiques**

## Education

2010–2016        PhD, **Northwestern University**  
Thesis Title: *Gauge Theoretic Aspects of the Geometric Langlands Correspondence*

2009–2010        MMath (Mathematics Tripos: Part III), **University of Cambridge**

2006–2009        BA (hons) (Mathematics), **University of Cambridge**

## Research Interests

I'm interested in mathematical aspects and applications of quantum field theory. In particular

- The construction and classification of (not necessarily topological) twists of classical and quantum field theories, especially using techniques of derived algebraic geometry and homotopical algebra.
- The connection between structures appearing in various versions of the geometric Langlands correspondence and twists of four-, five- and six-dimensional supersymmetric gauge theories.
- The theory of factorization algebras as a model for perturbative quantum field theory, possibly with boundary conditions and defects.

## Grants

1. NSF Conference Grant DMS-2329854, *Conference: New England Algebraic Topology and Mathematical Physics Seminar (NEAT MAPS)*

## Publications and Preprints

1. *Twists of Superconformal Algebras* (joint with Owen Gwilliam and Matteo Lotito), In preparation [https://chrisjelliott.github.io/Twists\\_of\\_Superconformal\\_Algebras.pdf](https://chrisjelliott.github.io/Twists_of_Superconformal_Algebras.pdf)
2. *Defects via Factorization Algebras* (joint with Ivan Contreras and Owen Gwilliam), accepted for publication in *Letters in Mathematical Physics*, 2023, <https://arxiv.org/abs/2208.01730>
3. *The derived pure spinor formalism as an equivalence of categories* (joint with Fabian Hahner and Ingmar Saberi), accepted for publication in *SIGMA*, 2023 <https://arxiv.org/abs/2205.14133>
4. *Framed  $\mathbb{E}_n$ -Algebras from Quantum Field Theory* (joint with Owen Gwilliam), accepted for publication in *Reviews in Mathematical Physics*, 2023, <https://arxiv.org/abs/2204.03702>

5. *Higher Deformation Quantization for Kapustin-Witten Theories* (joint with Owen Gwilliam and Brian Williams), <https://arxiv.org/abs/2108.13392>
6. *Quantum Geometric Langlands Categories from  $\mathcal{N} = 4$  Super Yang–Mills Theory* (joint with Philsang Yoo), <https://arxiv.org/abs/2008.10988>
7. *Spontaneous Symmetry Breaking: a View from Derived Geometry* (joint with Owen Gwilliam), *Journal of Geometry and Physics*, Vol 162, 2021, <https://arxiv.org/abs/2008.02302>
8. *Holomorphic Poisson Field Theories* (joint with Brian Williams), *Higher Structures*, Vol 5, Issue 1: 265-292, 2021 <https://arxiv.org/abs/2008.03599>
9. *A Taxonomy of Twists of Supersymmetric Yang–Mills Theory* (joint with Pavel Safronov and Brian Williams), *Selecta Mathematica*, Vol 28, Issue 4, 2022, <https://arxiv.org/abs/2002.10517>
10. *Multiplicative Hitchin Systems and Supersymmetric Gauge Theory* (joint with Vasily Pestun), *Selecta Mathematica*, Vol 25, Issue 64, 2019, <https://arxiv.org/abs/1812.05516>
11. *Topological Twists of Supersymmetric Algebras of Observables* (joint with Pavel Safronov), *Communications in Mathematical Physics*, Vol 371, pages 727–786, 2019, <https://arxiv.org/abs/1805.10806>
12. *A Physical Origin for Singular Support Conditions in Geometric Langlands* (joint with Philsang Yoo), *Communications in Mathematical Physics*, Vol 368, Issue 3, Pages 985–1050, 2019, <https://arxiv.org/abs/1707.01292>
13. *Asymptotic Freedom in the BV Formalism* (joint with Brian Williams and Philsang Yoo), *Journal of Geometry and Physics*, Vol 123, Jan 2018, Pages 246–283, <https://arxiv.org/abs/1702.05973>
14. *Geometric Langlands Twists of  $N = 4$  Supersymmetric Gauge Theory from Derived Algebraic Geometry* (joint with Philsang Yoo), *Advances in Theoretical and Mathematical Physics*, Vol 22, Number 3, Pages 615–708, 2018, <https://arxiv.org/abs/1507.03048>
15. *Abelian Duality for Generalised Maxwell Theories*, *Mathematical Physics, Analysis and Geometry*, Vol 22, Issue 22, 2019, <https://arxiv.org/abs/1402.0890>

## Teaching

Fall 2023	Amherst College Instructor, Groups, Rings and Fields Instructor, Multivariable Calculus Independent study instructor, Algebraic Topology
Spring 2023	Amherst College Instructor, Number Theory Instructor, Topology
Fall 2022	Amherst College Instructor, Linear Algebra Instructor, Multivariable Calculus
Spring 2022	University of Massachusetts, Amherst Instructor, Ordinary Differential Equations for Scientists and Engineers (two sections)
Fall 2021	University of Massachusetts, Amherst Instructor, Abstract Algebra I.
Spring 2021	University of Massachusetts, Amherst Co-instructor, Moduli Spaces in Representation Theory and Physics (graduate course). Instructor, Calculus II (two sections).
Fall 2020	University of Massachusetts, Amherst Instructor, Calculus II honors (two sections) Independent study instructor, Lie theory and Mathematical Physics.
Spring 2020	University of Massachusetts, Amherst Instructor, Calculus II (two sections).
Fall 2019	University of Massachusetts, Amherst Instructor, Calculus I Honors (two sections).

- 2011 – 2015 Northwestern University  
Teaching Assistant for courses including Introductory Calculus, Multivariate Calculus, Linear Algebra, Group Theory, Fourier Analysis, Graph Theory, Number Theory, and Algebraic Topology.
- Aug 2011 Northwestern University  
Summer Bridge Program Teaching Assistant (Preparatory summer course in precalculus)

## Mentoring and Service

- Summer 2023 Amherst College  
Summer Undergraduate Research Fellowships (SURF) mentor:  
Osha Jones and Ziji Zhou – “Twisting Quantum Field Theories: Nilp Variety in  $\mathfrak{osp}(k|4, \mathbb{C})$ ”
- Summer 2021 University of Massachusetts, Amherst  
REU (Research Experience for Undergraduates) mentor:  
Jiaxi Tian – “Lie Algebra Cohomology and Hamiltonian Vector Fields”
- Summer 2020 University of Massachusetts, Amherst  
Honors thesis committee member:  
Lucy Grossman – “Elliptic Curves, Manifolds, and Hodge Theory”.
- 2017–2023 Referee reports for *Advances in Mathematics*, *Annales Henri Poincaré*, *Communications in Mathematical Physics*, *Communications in Number Theory and Physics*, *Contemporary Mathematics*, *European Physical Journal Plus*, *Journal of Geometry and Physics*, *Journal of High Energy Physics*, *Journal of Mathematical Physics*.
- 2021 Grant proposal reviewer for NSERC (Canada).
- 2017–2023 Reviewer for Math Reviews and zbMath.

## Conference Organisation

- Jul 2024 Organizer  
*Physical Mathematics of Quantum Field Theory 2024*, University of Massachusetts, Amherst
- Mar 2024 Organizer  
*New England Algebraic Topology and Mathematical Physics Seminar (NEAT MAPS 3)*, Amherst College
- Nov 2023 Organizer  
*New England Algebraic Topology and Mathematical Physics Seminar (NEAT MAPS 2)*, Boston University
- Jul 2023 Organizer  
*Physical Mathematics of Quantum Field Theory 2023*, University of Massachusetts, Amherst
- Apr 2023 Organizer  
*New England Algebraic Topology and Mathematical Physics Seminar (NEAT MAPS)*, Northeastern University
- Mar 2023 Organizer  
*Gone Fishing 2023*, Amherst College
- Aug 2022 Organizer  
*Physical Mathematics of Quantum Field Theory 2022*, University of Massachusetts, Amherst (Postponed from 2020 due to COVID-19)
- Jul 2021 Organizer  
*Quantum Fields, Geometry and Representation Theory 2021*, ICTS, Bengaluru
- Jan 2019 Organizer  
*Non-Local Aspects of Holomorphic and Topological Field Theory*, IHÉS
- Dec 2014 Organizer  
*Workshop on Mathematical Aspects of Six-Dimensional Quantum Field Theories*, Berkeley
- Jan 2012 Organizer  
*Northwestern Masterclass in Gauge Theory*, Northwestern University

## Other Organisation

- 2020 Organizer  
*QFT and Representation Theory Working Seminar*, Online
- 2019 – 2022 Organizer  
*Representation Theory Seminar*, University of Massachusetts, Amherst
- 2012 – 2015 Organizer  
Series of learning seminars on various topics in mathematical physics and representation theory.
- Jan–Feb 2012 Organizer  
*Northwestern Preseminar for Simons Center Supersymmetric Gauge Theory Workshop*

## Invited Lecture Series

- Oct 2017 Hausdorff Institute for Mathematics,  
*An Algebraic Introduction to Kapustin-Witten Theory*

## Invited Research Talks

- Oct 2023 AGNES (Algebraic Geometry, North East Section), University of Pennsylvania
- Sep 2023 Math and Computer Science Seminar, Bard College  
*Supersymmetry and Superalgebra*
- May 2023 Global Categorical Symmetries Colloquium, Perimeter Institute  
*Framing Anomalies and Kapustin-Witten Theory*
- Dec 2022 Topology, Algebraic Geometry, and Dynamics Seminar, George Mason University  
*Topological Field Theory and Homological Algebra*
- Dec 2022 Math-Physics Joint Seminar, University of Pennsylvania  
*Supersymmetric Quantum Field Theory in Mathematics*
- Nov 2022 Geometry and Physics Seminar, Boston University  
*Topological Field Theory and Homological Algebra*
- Jul 2022 Deformation Theory Seminar, University of Pennsylvania  
*Framing Anomalies for Topological AKSZ Theories*
- Jun 2022 Workshop on Topology and QFT, Notre Dame University  
*Supersymmetry and Pure Spinors*
- Apr 2022 Math-Physics Seminar, ICTS, Bengaluru  
*Framing Anomalies for Topological AKSZ Theories*
- Nov 2021 Maths HEP Seminar, Durham University  
*Framing Anomalies for Topological AKSZ Theories*
- Nov 2021 Pure Mathematics Seminar, Montana State University  
*Kapustin–Witten Theory and Factorization Homology*
- Mar 2021 Mathematical Physics Seminar, University of Nottingham  
*Gauge Symmetry via Derived Geometry*
- May 2020 Higgs Bundles & Related Topics, Online Workshop  
*The Multiplicative Hitchin System*
- May 2020 Holomorphic Quantum Field Theories, IPMU  
Cancelled due to COVID-19
- Oct 2019 Geometric Representation Theory Seminar, Fields Institute  
*A Catalogue of Twists for Supersymmetric Quantum Field Theory*
- Sep 2019 Mathematical Physics Seminar, Boston University  
*Supersymmetric Quantum Field Theory and its Twists*
- Mar 2019 MAGIC Seminar, Imperial College London  
*Supersymmetric Quantum Field Theory and its Twists*
- Feb 2019 Geometry and Mathematical Physics Seminar, University of Birmingham  
*The Multiplicative Hitchin System in Supersymmetric Gauge Theory*

- Jan 2019 Colloquium, Rutgers University, Newark  
*Twisted Classical and Quantum Field Theory*
- Nov 2018 Geometry, Symmetry and Physics Seminar, Yale University  
*The Multiplicative Hitchin System in Supersymmetric Gauge Theory*
- Nov 2018 Geometry, Physics, and Representation Theory Seminar, Northeastern University  
*The Multiplicative Hitchin System in Supersymmetric Gauge Theory*
- May 2018 Algebraic Geometry Seminar, IST Austria,  
*Topological Twists of Supersymmetric Factorization Algebras*
- Apr 2018 Edinburgh Geometry Seminar, University of Edinburgh,  
*The Multiplicative Hitchin System in Supersymmetric Gauge Theory*
- Dec 2017 Higher Categories and Mirror Symmetry, KIAS Seoul,  
*Singular Support Conditions for Coherent Sheaves Coming From Vacua*
- Oct 2017 Topology Seminar, MPIM Bonn,  
*Topological Twists of Factorization Algebras*
- Jun 2017 Séminaire Groupes de Lie et Espaces des Modules, Université de Genève,  
*Vacua and Singular Supports*
- May 2017 Mathematical Physics Seminar, Perimeter Institute,  
*Vacua and Singular Supports*
- Mar 2017 Formal Aspects of String Theory Kickoff Meeting, University of Amsterdam,  
*Algebraic Structures for Kapustin-Witten Twisted Gauge Theories*
- Feb 2017 Physical Mathematics Seminar, Universität Heidelberg  
*Algebraic Structures for Kapustin-Witten Twisted Gauge Theories*
- Jan 2017 Quantization and Moduli Spaces, Université du Luxembourg,  
*Algebraic Structures for Kapustin-Witten Twisted Gauge Theories*
- Nov 2016 Algebraic Analysis Seminar, Institut de Mathématiques de Jussieu Paris Rive Gauche,  
*Algebraic Structures for Kapustin-Witten Twisted Gauge Theories*
- Nov 2016 Higher Differential Geometry Seminar, MPIM Bonn,  
*Algebraic Structures for Kapustin-Witten Twisted Gauge Theories*
- Dec 2014 Geometry and Physics Seminar, Boston University  
*Fourier Duality in Higher Abelian Gauge Theories*
- Oct 2014 Homological Methods in Quantum Field Theory, Simons Center  
*Non-perturbative Descriptions for Twists of Classical Field Theories*
- May 2014 Representation Theory, Integrable Systems and Quantum Field Theory, Northwestern University  
*Fourier Duality in Higher Abelian Gauge Theories*
- Mar 2014 MAGIC Seminar, Imperial College London  
*Fourier Duality in Higher Abelian Gauge Theories*
- Apr 2013 GRASP Seminar, UC Berkeley  
*Abelian Duality for Generalised Maxwell Theories*

## Contributed and Expository Talks

- Apr 2022 Undergraduate Colloquium, Amherst College  
*Quantum Theory and Topology*
- Mar 2021 TWIGS (The What Is Graduate Seminar), University of Massachusetts, Amherst  
*What is Supersymmetry?*
- Jan 2020 Geometry and Topology Seminar, University of Massachusetts, Amherst  
*The Multiplicative Hitchin System*
- Oct 2019 Representation Theory Seminar, University of Massachusetts, Amherst  
*Supersymmetric Field Theory and its Twists*
- Jul 2019 QFT for Mathematicians, Perimeter Institute (teaching assistant)  
*Supersymmetry Algebras Yang-Mills Theory and Asymptotic Freedom*

- Aug 2018 Higher Algebra and Mathematical Physics, MPIM Bonn  
*Topological Twists of Supersymmetric Factorization Algebras*
- Feb 2017 Introductory Seminar, Universität Heidelberg  
*An Introduction to the BV Formalism*
- Jan 2015 Northwestern Graduate Student Seminar  
*Representations of the Poincaré Group*
- Oct 2013 Northwestern Graduate Student Seminar  
*The Feynman Path Integral*
- Mar 2013 Brownbag Seminar, Northwestern Physics Department  
*Topological Quantum Field Theory*
- Oct 2012 Northwestern Graduate Student Seminar  
*Dirac Quantisation*
- Aug 2012 Categorical Representation Theory Workshop, University of Oregon  
*TQFTs from Quasicoherent Sheaves on Stacks*
- Mar 2012 Simons Center Graduate Workshop in Supersymmetric Gauge Theory  
*Supersymmetric Lagrangians*
- Feb 2012 Northwestern Preseminar for Simons Center Supersymmetric Gauge Theory Workshop  
*Classical Lagrangian Field Theory*
- Oct 2011 Northwestern Graduate Student Seminar  
*What is Intersection Homology?*
- May 2011 MIT Talbot Workshop,  
*The Non-Abelian Hodge Correspondence for Non-Compact Curves*
- Apr 2011 Northwestern Pre-Talbot Seminar  
*Twistor Space Constructions of Hyper-Kähler Manifolds*