Christopher Elliott

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 Visits

2014–2018	**Perimeter Institute** (7 visits)
Oct–Nov 2017	**MPIM**, Bonn
Oct 2017	**Hausdorff Institute**, Bonn
Nov 2016	**MPIM**, Bonn

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.

Publications and Preprints

1. *Defects via Factorization Algebras* (joint with Ivan Contreras and Owen Gwilliam), arxiv.org/abs/2208.01730
2. *The derived pure spinor formalism as an equivalence of categories* (joint with Fabian Hahner and Ingmar Saberi), arxiv.org/abs/2205.14133
3. *Framed $\mathbb{E}_n$-Algebras from Quantum Field Theory* (joint with Owen Gwilliam), arxiv.org/abs/2204.03702
4. *Higher Deformation Quantization for Kapustin-Witten Theories* (joint with Owen Gwilliam and Brian Williams), arxiv.org/abs/2108.13392

5. *Quantum Geometric Langlands Categories from $\mathcal{N} = 4$ Super Yang–Mills Theory* (joint with Philsang Yoo), arXiv:2008.10988

6. *Spontaneous Symmetry Breaking: a View from Derived Geometry* (joint with Owen Gwilliam), Journal of Geometry and Physics, Vol 162, 2021, arXiv:2008.02302

7. *Holomorphic Poisson Field Theories* (joint with Brian Williams), Higher Structures, Vol 5, Issue 1: 265-292, 2021 arXiv:2008.03599

8. *A Taxonomy of Twists of Supersymmetric Yang–Mills Theory* (joint with Pavel Safronov and Brian Williams), Selecta Mathematica, Vol 28, Issue 4, 2022, arXiv:2002.10517

9. *Multiplicative Hitchin Systems and Supersymmetric Gauge Theory* (joint with Vasily Pestun), Selecta Mathematica, Vol 25, Issue 64, 2019, arXiv:1812.05516

10. *Topological Twists of Supersymmetric Algebras of Observables* (joint with Pavel Safronov), Communications in Mathematical Physics, Vol 371, pages 727– 786, 2019, arXiv:1805.10806

11. *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, arXiv:1707.01292

12. *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, arXiv:1702.05973

13. *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, arXiv:1507.03048

14. *Abelian Duality for Generalised Maxwell Theories*, Mathematical Physics, Analysis and Geometry, Vol 22, Issue 22, 2019, arXiv:1402.0890

Invited Lecture Series

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

Invited Research Talks

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 Mathematiques 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*

Conference Organisation

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

Other Organisation

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

Teaching

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 Massachuestts, Amherst Instructor, Abstract Algebra I.
Spring 2021	University of Massachuestts, 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) Undergraduate reading course on 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 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”.
2017–2022	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).
2017–2022	Reviewer for Math Reviews and zbMath.