### Curriculum Vitae

### **Alexander Schenkel**

Associate Professor in Mathematical Physics School of Mathematical Sciences University of Nottingham University Park Nottingham NG7 2RD, United Kingdom

**a** +44 (0) 115 95 13840

 $\boxtimes$  alexander.schenkel@nottingham.ac.uk

 $\boxtimes$  aschenkel83@gmail.com

 $\bullet$  www.nottingham.ac.uk/mathematics/people/alexander.schenkel

🐑 www.aschenkel.eu

#### **University Education**

06/2008-10/2011 PhD Student, Department of Physics, University of Würzburg, Germany. PhD Thesis in Mathematical Physics: "Noncommutative gravity and quantum field theory on noncommutative curved spacetimes" (summa cum laude) Supervisor: Prof. Dr. Thorsten Ohl
10/2003-06/2008 Student of Physics, University of Würzburg, Germany.

Diploma Thesis: "Pseudo-local Dirac observables in effective theories of quantum gravity" (summa cum laude) Supervisor: Prof. Dr. Thorsten Ohl

#### **Research and Academic Positions**

since 10/2021	Associate Professor in Mathematical Physics, School of Mathematical Sciences, University of Nottingham, UK.
08/2019-09/2021	Principal Research Fellow (equivalent to Associate Professor, but with a focus on research), School of Mathematical Sciences, University of Nottingham, UK.
10/2016-09/2024	Royal Society University Research Fellow, School of Mathematical Sciences, University of Nottingham, UK.
09/2016-07/2019	Assistant Professor in Mathematical Physics, School of Mathematical Sciences, University of Nottingham, UK.
04/2016-08/2016	Postdoctoral Position, Department of Mathematics, University of Regensburg, Germany. Member of the working group of Prof. Dr. Ulrich Bunke.
04/2014-03/2016	Postdoctoral Research Fellow, Department of Mathematics, Heriot-Watt University, Edinburgh, UK. Member of the Mathematical Physics Group. Funded by a Research Fellowship of Deutsche Forschungsgemeinschaft (DFG).
09/2011-03/2014	Postdoctoral Position, Department of Mathematics, University of Wuppertal, Germany. Member of the working group of Prof. Dr. Hanno Gottschalk.

### **Fellowships and Grants**

07/2023-09/2024	Royal Society Enhanced Research Expenses (RF\ERE\231077) Value: £87,937.07 $\approx$ 105,465.13 $\in$ Purpose: Covered expenses for a 12 months postdoctoral researcher at the University of Nottingham, UK.
12/2021-01/2023	Royal Society Research Fellows Enhanced Research Expenses (RF\ERE\210053) Value: £100,376.80 $\approx$ 120,384.41 $\in$ Purpose: Covered expenses for a 14 months postdoctoral researcher at the University of Nottingham, UK.
10/2021-09/2024	Royal Society University Research Fellowship Renewals (URF\R\211015) Value: £325,879.13 $\approx$ 390,834.99 $\in$ Purpose: Covered my salary and research expenses for a 3-year period at the University of Nottingham, UK.
03/2020-03/2022	Royal Society Enhancement Award (RGF\EA\201051) Value: $\pounds 14,100.00 \approx 16,910.48 \in$ Purpose: Covered additional expenses for international collaborations for a 2-year period at the University of Nottingham, UK.
12/2017-03/2022	Royal Society Enhancement Award (RGF\EA\180270) Value: £79,492.00 $\approx$ 95,336.74 $\in$ Purpose: Covered expenses for a 4-year PhD student at the University of Nottingham, UK.
03/2017-09/2021	Royal Society Research Grant (RG160517) Value: £81,312.00 $\approx$ 97,519.51 $\in$ Purpose: Covered expenses for a 4-year PhD student at the University of Nottingham, UK.
10/2016-09/2021	Royal Society University Research Fellowship (UF150099) Value: £391,518.76 $\approx$ 469,558.24 $\in$ Purpose: Covered my salary and research expenses for a 5-year period at the University of Nottingham, UK.
04/2014-03/2016	Research Fellowship of Deutsche Forschungsgemeinschaft (DFG, Germany) Purpose: Covered my salary and research expenses for a 2-year postdoctoral fellowship at Heriot-Watt University, Edinburgh, UK. https://gepris.dfg.de/gepris/projekt/252118965
09/2012	Research in Pairs, Mathematisches Forschungsinstitut Oberwolfach (MFO) Purpose: 2 weeks research collaboration with Thomas-Paul Hack.
01/2010	Short Visit Grant, ESF Activity "Quantum Geometry and Quantum Gravity" Purpose: 2 weeks research collaboration with Paolo Aschieri at the University of Alessandria, Italy.

# **Postdocs and Students**

Postdocs:

2022-2024	Alastair Grant-Stuart (University of Nottingham) Funded by the Royal Society Grants RF\ERE\210053 and RF\ERE\231077
PhD students:	
since 2022	Supervisor of James MacManus (University of Nottingham) Working Title: "Lorentzian bordisms in functorial and algebraic QFT"
since 2022	Co-supervisor of Cameron Kemp (University of Nottingham) Working Title: "Derived geometry and (higher) quantum groups"
2018-2022	Supervisor of Hans Nguyen (University of Nottingham) Thesis: "Dirac operators and Batalin-Vilkovisky quantisation in noncommutative geometry" https://eprints.nottingham.ac.uk/id/eprint/72392
2018-2022	Supervisor of Marco Perin (University of Nottingham) Thesis: "Categorical aspects of algebraic quantum field theory" https://eprints.nottingham.ac.uk/id/eprint/71595
2017-2021	Supervisor of Simen Bruinsma (University of Nottingham) Thesis: "Higher linear algebraic quantum field theory" https://eprints.nottingham.ac.uk/id/eprint/68680
2011-2014	Co-supervisor of Marco Benini (University of Pavia) Thesis: "Locality in Abelian gauge theories over globally hyperbolic spacetimes" https://arxiv.org/pdf/1503.00131
MSc and MMath	students:
2024	Supervisor of Cameron Lee (University of Nottingham) Thesis: "Feynman diagrams from homological algebra"
2021	Supervisor of James Mitton (University of Nottingham) Thesis: "Boundaries and edge mode dynamics in $(2 + 1)$ -dimensional gravity"
2020-2021	Supervisor of Zia Rehman (University of Nottingham) Thesis: "Cohomological techniques for Abelian gauge theory"
2020-2021	Supervisor of Henry Taylor (University of Nottingham) Thesis: "Deformation quantisation"
2020	Supervisor of Rory Whybrow (University of Nottingham) Thesis: "Boundary conditions and edge modes in gauge theories"
2019-2020	Supervisor of Cameron Bunney (University of Nottingham) Thesis: "Principal bundles, connections and gauge theory"
2019	Supervisor of Ferran de Palol Coma (University of Nottingham) Thesis: "Covariant phase space methods in field theory"

- 2018 Supervisor of Anant Saxena (University of Nottingham) Thesis: "Quantum field theory on spacetimes with time-like boundary"
- 2017 Supervisor of John Shade (University of Nottingham) Thesis: "Noncommutative differential geometry of Yetter-Drinfeld module algebras"

2015-2016	Co-supervisor of Angelo Cuzzola (University of Bologna) Thesis: "Aspects of supergeometry in locally covariant quantum field theory"
Project students:	
2024	Supervisor of Tomás Fernández Pra Baldi (ENS Lyon) Internship Project: "The derived critical locus of the Yang-Mills equation on a 2 dimensional lattice" Publication: https://arxiv.org/abs/2409.06873
2024	Supervisor of Thomas Bacon (University of Nottingham) Internship Project: "Homological algebra of lattice wave equations"
2023	Supervisor of Martin Ray (University of Nottingham) Internship Project: "Homological algebra of wave equations"
2022	Supervisor of Thomas Richardson (University of Nottingham) Internship Project: "De Rham cohomology with holomorphic boundary condi- tions"
2019-2020	Supervisor of Solveig Wittig (University of Würzburg) Erasmus+ Project: "Higher structures in quantum field theory"
2019	Supervisor of Samuel Hannah (University of Nottingham) Internship Project: "Singularity theorems in general relativity"

# Teaching

 $At\ the\ University\ of\ Nottingham:$ 

09/2024-05/2025	Quantum Field Theory Details: Year 4 module for mathematics and physics students; 32 hours of lectures and 20 hours of student presentations; assessment via 4 pieces of marked coursework and 1 marked student presentation; approximately 30 participants; lecture notes prepared in pdf and html.
09/2023-05/2024	Quantum Field Theory Details: Year 4 module for mathematics and physics students; 32 hours of lectures and 20 hours of student presentations; assessment via 4 pieces of marked coursework and 1 marked student presentation; approximately 30 participants; lecture notes prepared in pdf and html.
09/2022-05/2023	Quantum Field Theory Details: Year 4 module for mathematics and physics students; 32 hours of lectures and 20 hours of student presentations; assessment via 4 pieces of marked coursework and 1 marked student presentation; approximately 30 participants; lecture notes prepared in pdf and html.
01/2022-05/2022	Relativity Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

01/2021-05/2021 Relativity

Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

01/2020-05/2020 Relativity

Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

01/2019-05/2019 Relativity

Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

#### 01/2018-05/2018 Relativity

Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

01/2017-05/2017 Relativity

Details: Year 3 module for mathematics and physics students; 34 hours of lectures and 10 hours of problem classes; assessment via 1 written exam; approximately 50 participants; lecture notes prepared in pdf.

At the University of Regensburg:

notes.

- 04/2016-07/2016 Mathematical aspects of quantum field theory Details: Specialized lectures for PhD students and researchers; 24 hours of lectures; approximately 10 participants; no assessment; handwritten lecture
- 04/2016-07/2016 Probability theory Details: Organization of the tutorials and problem sheets; 24 hours of problem classes; approximately 20 participants.
- At the University of Wuppertal:
- 10/2013-02/2014 Geometric aspects of supergravity and string theory Details: Specialized lectures for MSc students; 24 hours of lectures; approximately 5 participants; no assessment; handwritten lecture notes.
- 10/2013-02/2014 Stochastics and probability theory Details: Organization of the tutorials and problem sheets; 24 hours of problem classes; approximately 20 participants.
- 04/2013-07/2013 Applied statistics Details: Organization of the tutorials and problem sheets; 24 hours of problem classes; approximately 20 participants.
- 04/2013-07/2013 Z<sub>2</sub>-graded algebra and supergeometry Details: Specialized lectures for MSc students; 24 hours of lectures; approximately 5 participants; no assessment; handwritten lecture notes.

10/2012-02/2013	Stochastics and probability theory	
	Details: Organization of the tutorials and problem sheets; 48 hours of problem classes; approximately 40 participants.	
04/2012-07/2012	Partial differential equations Details: Specialized lectures for MSc students; 48 hours of lectures; approxi- mately 5 participants; assessment via oral exam; handwritten lecture notes.	
10/2011-02/2012	Stochastics and probability theory Details: Organization of the tutorials and problem sheets; 48 hours of problem classes; approximately 40 participants.	
Teaching Assistance at the University of Würzburg:		
10/2010-02/2011	Theoretical Mechanics	
10/2009-12/2009	Theoretical Electrodynamics	
10/2008-02/2009	Statistical Physics	
04/2008-07/2008	Quantum Mechanics	
10/2007-02/2008	Theoretical Electrodynamics	

#### Administrative Duties

- ▷ Since October 2024: Course director for the Gravity, Particles and Fields MSc, School of Mathematical Sciences, University of Nottingham UK.
- $\triangleright$  Member of the Royal Society's International Exchanges Panel (01/2019-12/2024).
- Grant proposal reviewer for various councils, including: Engineering and Physical Sciences Research Council (EPSRC, UK); Royal Society (UK); Marie Sklodowska Curie Actions (EU); German Research Foundation (DFG, Germany); Alexander von Humboldt Foundation (AvH, Germany); German Academic Exchange Service (DAAD, Germany); Canada Research Chairs (CRC, Canada); Netherlands Organisation for Scientific Research (NWO, Netherlands); Czech Science Foundation (Czech Republic); National Science Centre (NCN, Poland).
- ▷ Referee for various journals, including: Communications in Mathematical Physics; Annales Henri Poincaré; Letters in Mathematical Physics; Reviews in Mathematical Physics; Journal of Mathematical Physics; Mathematical Physics, Analysis and Geometry.
- ▷ Referee for book publishers: Springer; World Scientific Publishing Co.

#### Workshop Organization

01/2024	Organizer of the $7^{\text{th}}$ AQFTUK meeting, University of Nottingham, UK.
09/2022	Organizer of the 4 <sup>th</sup> AQFTUK meeting, University of Nottingham, UK.
12/2016	Organizer of the Mini-Workshop: New interactions between homotopical algebra and quantum field theory, Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany. (With M. Benini, K. Rejzner and C. Schweigert.)
05/2013	Organizer of the 32 <sup>nd</sup> Workshop: Foundations and Constructive Aspects of QFT, University of Wuppertal, Germany. (With H. Gottschalk.)

### Invited Conference and Workshop Talks

03/2023	"Quantum field theories on Lorentzian manifolds" at Geometric/Topological Quantum Field Theories and Cobordisms 2023, NYU Abu Dhabi.
11/2022	"Derived algebraic geometry in mathematical physics" at Interactions and Appli- cations of Homotopical Algebra and Geometry, Luxembourg.
07/2022	"BV and BFV formalism beyond perturbation theory" at the $3^{\rm rd}$ AQFTUK Meeting, York.
07/2019	"Higher structures in algebraic quantum field theory" at Mathematics of inter- acting QFT models, York.
06/2019	"Factorization Algebras vs Algebraic QFT" at NBMPS 56, York.
08/2018	"Higher structures in algebraic quantum field theory" at Higher Structures in M-Theory, LMS–EPSRC Durham Symposium.
06/2018	"Homotopical algebraic quantum field theory" at Algebraic Quantum Field Theory: Where Operator Algebra meets Microlocal Analysis, Cortona.
12/2017	"From Fredenhagen's universal algebra to homotopy theory and operads" at Quantum Physics meets Mathematics – A workshop on the occasion of Klaus Fredenhagen's 70th birthday, Hamburg.
09/2017	"The stack of Yang-Mills fields" at Modern Mathematics of Quantum Theory, York.
07/2017	"Towards homotopical algebraic quantum field theory" at Higher Structures Lisbon 2017, Instituto Superior Técnico, Lisbon.
05/2017	"Towards homotopical algebraic quantum field theory" at Foundational and structural aspects of gauge theories, MITP Mainz.
04/2017	"Homotopy Theory + AQFT = Quantum Gauge Theory?" at Quantum Field Theory: Concepts, Constructions & Curved Spacetimes, York.
05/2016	"Mapping spaces and automorphism groups of toric noncommutative spaces" at the Workshop on Quantum spacetime structures: Dualities and new geometries, Bayrischzell.
06/2015	"Nonassociative geometry in quasi-Hopf representation categories" in the Special Session on Algebraic and Categorical Aspects of Hopf Algebras at the AMS–EMS–SMP Meeting 2015, Porto.
09/2014	"On the problem of gauge theories in locally covariant QFT" at the Workshop on Operator and Geometric Analysis on Quantum Theory, Levico Terme.
05/2014	"Abelian quantum gauge theories via differential cohomology" at the Workshop on Algebraic quantum field theory: its status and its future, Erwin Schrödinger International Institute for Mathematical Physics (ESI), Vienna.
07/2013	"Quantized Abelian principal connections on Lorentzian manifolds" at the Mini- Workshop: New Crossroads between Mathematics and Field Theory, Mathema- tisches Forschungsinstitut Oberwolfach (MFO).

09/2012	"Quantum field theory on affine bundles" at the Workshop: Algebraic Quantum Field Theory and Local Symmetries, Hausdorff Research Institute for Mathematics (HIM) Bonn.
06/2012	"Product module homomorphisms and connections in twist deformed NC ge- ometry" at the Workshop on Gauge Theory and Noncommutative Geometry, Luxembourg.
09/2011	"Twist deformations of module homomorphisms and connections" at the Workshop on Noncommutative Field Theory and Gravity, Corfu.
09/2010	"Quantum field theory on NC curved spacetimes" at the Workshop: Deforma- tion Methods in Mathematics and Physics, Mathematisches Forschungsinstitut Oberwolfach (MFO).
05/2010	"Field theory on curved NC spacetimes" at the Workshop on Noncommutativity and Physics: Spacetime Quantum Geometry, Bayrischzell.
05/2009	"Noncommutative symmetry reduction: Backgrounds and quantum fields" at the Workshop on Noncommutativity and physics: Quantum Geometries and Gravity, Bayrischzell.

# **Invited Lectures**

Interactions between Poisson Geometry and Quantisation, University of Göttin- gen, Germany.
Title: "Higher structures and quantization"
Details: 4 one-hour lectures for PhD students and researchers.
Higher Structures and Field Theory, Erwin Schrödinger Institute, Austria. Title: "Higher structures in algebraic quantum field theory" Details: 3 one-hour lectures for PhD students and researchers.
NIMS Winter School for Quantum Gravity and Cosmology, Daejeon, South Korea.
Title: "Noncommutative geometry and gravity" Details: 4 one-hour lectures for PhD students and researchers.

# **Invited Seminar Talks**

04/2024	"Quantum field theory on Lorentzian manifolds", Edinburgh Mathematical Physics Group Seminar.
03/2024	"On Møller maps and gauge symmetries", Mathematical Physics Seminar, University of York.
11/2023	"Quantum field theories on Lorentzian manifolds", Topology Seminar, University of Oxford.
09/2023	"Bordisms in algebraic quantum field theory", Mathematics Seminar, University of Genova.
04/2023	"Derived algebraic geometry in mathematical physics", Séminaire de Physique Mathématique, Institut Camille Jordan, Lyon.

05/2022	"Quantization of derived cotangent stacks", Quantum Algebra Seminar, Queen Mary University of London.
04/2022	"BV and BFV formalism beyond perturbation theory", Mathematical Physics Seminar, University of Hertfordshire.
03/2022	"An AQFT perspective on quantum gauge theories", Topology and Geometry Seminar, Texas Tech University.
01/2022	"On the time-slice axiom in 2d conformal AQFT", Mathematical Physics Seminar, University of York.
01/2021	"Boundary conditions and edge modes in gauge theories", Institute of Mathe- matics of the Czech Academy of Sciences.
01/2020	"2-algebraic quantum field theory", Mathematical Physics Seminar, University of York.
10/2019	"Higher categorical structures in algebraic quantum field theory", Topology Seminar, University of Sheffield.
09/2019	"Boundaries and edge modes in gauge theories", London Relativity and Cosmology Seminar, Queen Mary University of London.
09/2019	"Boundaries and edge modes in gauge theories", Mathematics Seminar, University of Genova.
05/2019	"Higher structures in algebraic quantum field theory", Quantum Algebra Seminar, Queen Mary University of London.
04/2019	"An introduction to algebraic quantum field theory" & "Higher structures in algebraic quantum field theory", Topology Seminar, Notre Dame University.
04/2018	"Homotopical algebraic quantum field theory", Quantum Field Theory Seminar, University of Oxford.
04/2018	"Homotopical algebraic quantum field theory", Pure Mathematics Colloquium, University of Hamburg.
11/2017	"Homotopical algebraic quantum field theory", Séminaire de Physique Mathéma- tique, Institut Camille Jordan, Lyon.
10/2017	"The stack of Yang-Mills fields", Fields, Strings and Geometry Seminar, University of Surrey.
11/2016	"Mapping spaces and automorphism groups in toric NC geometry", Algebra and Topology Seminar, Swansea University.
10/2016	"Towards homotopical algebraic quantum field theory", Geometry, Algebra, Mathematical Physics & Topology Seminar, Cardiff University.
01/2016	"Abelian $S\mbox{-}{\rm duality:}$ An algebraic perspective", Mathematical Physics Seminar, University of York.
07/2015	"On gauge theories in LCQFT and why we need more homotopical algebra", Seminar on Quantum Field Theory, Gravitation, and Elementary Particles, University of Leipzig.

04/2015	"Gauge theories in locally covariant quantum field theory", Mathematics Seminar, University of Regensburg.
04/2015	"Gauge theories in locally covariant quantum field theory", Mathematical Physics Seminar, University of Würzburg.
04/2015	"Gauge theories in locally covariant quantum field theory", Mathematical Physics Seminar, University of York.
01/2015	"Supergeometry in locally covariant quantum field theory", Mathematics Seminar, University of Genova.
05/2014	"Differential cohomology and locally covariant quantum field theory", Differential Geometry Seminar, University of Potsdam.
12/2013	"The inhomogeneous Klein-Gordon field: A new standard model for LCQFT", Mathematical Physics Seminar, University of Pavia.
10/2013	"Algebraic quantum field theory and gauge theory", Mathematics Seminar, Charles University Prague.
09/2013	"Topological aspects of Abelian gauge theories in algebraic quantum field theory", Mathematical Physics Seminar, University of York.
04/2013	"Quantized Abelian principal connections on Lorentzian manifolds", Differential Geometry Seminar, University of Potsdam.
02/2013	"Category theoretical description of matter and gauge QFTs", Center for Quantum Spacetime (CQUeST) Seminar, Seoul.
03/2012	"Parallel transport on modules and application to fuzzy gauge theory", Edinburgh Mathematical Physics Group Seminar.
11/2011	"The Maxwell field on curved spacetimes: A projective module approach", Algebraic Quantum Field Theory Seminar, University of Hamburg.
01/2011	"Quantum field theory on noncommutative curved spacetimes", Center for Quantum Spacetime (CQUeST) Seminar, Seoul.
11/2010	"QFT on noncommutative curved spacetimes", Algebraic Quantum Field Theory Seminar, University of Hamburg.
02/2010	"Algebraic approach to quantum field theory on noncommutative curved space- times", Mathematical Physics Seminar, University of Vienna.
01/2010	"Algebraic approach to quantum field theory on noncommutative curved space- times", Mathematical Physics Seminar, University of Alessandria.

# Public Outreach

11/2024	Appeared on the YouTube channel SpaceTyme of one of Nottingham's MSc students for a discussion about quantum field theory and mathematical physics.
07/2023	Lectures at the LMS Undergraduate Summer School, 16-28 July 2023, University of Sheffield, UK.
	Title: "Interactions between algebra, geometry and quantum theory" Details: 5 lectures and 2 exercise classes for undergraduate students.

07/2019	Lecture at the Sutton Trust Summer School, 22-25 July 2019, University of Nottingham, UK.
	Title: "The homophonic group and a short introduction to group theory" Details: One hour lecture for year 12 school students interested in mathematics.
2008-2011	Co-organization of open days for school students, teachers and the science inter- ested public at the Department of Physics, University of Würzburg, Germany.

Nottingham, March 29, 2025