

Curriculum Vitae

Dr. Alexander Schenkel

Professional address

School of Mathematical Sciences
University of Nottingham
University Park
Nottingham NG7 2RD, United Kingdom

☎ +44 (0) 115 95 13840

✉ alexander.schenkel@nottingham.ac.uk

✉ aschenkel83@gmail.com

🌐 www.nottingham.ac.uk/mathematics/people/alexander.schenkel

🌐 www.aschenkel.eu

Research interests

- ▷ Mathematical physics, algebra and topology
 - ▷ Higher categorical structures in quantum field theory
 - ▷ Classical and quantum gauge theory on Lorentzian manifolds
 - ▷ Noncommutative differential geometry, Hopf algebras and deformation quantization
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Scientific positions

- since 08/2019 Associate Professor in Mathematical Physics, School of Mathematical Sciences, University of Nottingham, UK.
- since 10/2016 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).
- 04/2012-03/2014 Temporary Lecturer (“Lehrbeauftragter”), Faculty of Sciences and Mathematics, University of Wuppertal, Germany.
- 09/2011-03/2014 Postdoctoral Position, Department of Mathematics, University of Wuppertal, Germany. Member of the working group of Prof. Dr. Hanno Gottschalk.

University education

- 06/2008-10/2011 PhD student in Theoretical Physics, University of Würzburg, Germany.
Member of the Research Training Group GRK1147
“Theoretical Astrophysics and Particle Physics”
PhD thesis:
“*Noncommutative gravity and quantum field theory on noncommutative curved spacetimes*”
Referees: Prof. Dr. Thorsten Ohl, Prof. Dr. Haye Hinrichsen, Prof. Dr. Peter Schupp
Submitted: June 14, 2011; PhD Viva: October 24, 2011
(passed with distinction, *summa cum laude*)
- 08/2005-06/2008 Advanced studies in Physics, University of Würzburg, Germany.
Diploma thesis: (Advisor: Prof. Dr. Thorsten Ohl)
“*Pseudo-local Dirac observables in effective theories of quantum gravity*”
Qualification: Diplom (passed with distinction)
- 10/2003-08/2005 Basic studies in Physics, University of Würzburg, Germany.
Qualification: Vordiplom (passed with distinction)

Scholarships and grants

- 07/2023-09/2024 Royal Society Enhanced Research Expenses (£87,937.07)
- 12/2021-01/2023 Royal Society Research Fellows Enhanced Research Expenses (£100,376.80)
- 10/2021-09/2024 Royal Society University Research Fellowship Renewals (£325,879.13)
- 03/2020-03/2022 Royal Society Enhancement Award (£14,100.00)
- 12/2017-03/2022 Royal Society Enhancement Award (£79,492.00)
- 03/2017-09/2021 Royal Society Research Grant (£81,312.00)
- 10/2016-09/2021 Royal Society University Research Fellowship (£391,518.76)
- 04/2014-03/2016 Research Fellowship of Deutsche Forschungsgemeinschaft (DFG, Germany)
- 09/2012 Research in Pairs (2 weeks with T.-P. Hack), Mathematisches Forschungsinstitut Oberwolfach (MFO)
- 01/2010 Short Visit Grant (2 weeks with P. Aschieri at the University of Alessandria), ESF Activity “Quantum Geometry and Quantum Gravity”
- 06/2008-05/2011 Full scholarship within the Research Training Group GRK1147 “Theoretical Astrophysics and Particle Physics”, University of Würzburg

Awards

- 05/2012 “Stiftungspreis der Unterfränkischen Gedenkjahrstiftung für Wissenschaft” for an exceptional PhD thesis
- 12/2011 Wilhelm-Conrad-Röntgen Award of the Faculty of Physics and Astronomy of the University of Würzburg for one of the year’s best PhD theses
- 12/2008 Wilhelm-Conrad-Röntgen Award of the Faculty of Physics and Astronomy of the University of Würzburg for one of the year’s best Diploma theses

Postdocs and students

Postdocs:

- since 2022 Alastair Grant-Stuart (University of Nottingham)
Funded by the Royal Society Enhancement Grant RF\ERE\210053

PhD students:

- since 2022 Supervisor of James MacManus (University of Nottingham)
Working Title: “Homotopy coherent structures in 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”
- 2018-2022 Supervisor of Marco Perin (University of Nottingham)
Thesis: “Categorical aspects of algebraic quantum field theory”
- 2017-2021 Supervisor of Simen Bruinsma (University of Nottingham)
Thesis: “Higher linear algebraic quantum field theory”
- 2011-2014 Co-supervisor of Marco Benini (University of Pavia)
Thesis: “Locality in Abelian gauge theories over globally hyperbolic spacetimes”

MSc and MMath students:

- 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:

- 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 conditions”
- 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”

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 Applications of Homotopical Algebra and Geometry*, Luxembourg
- 07/2022 “BV and BFV formalism beyond perturbation theory” at the 3rd *AQFTUK Meeting*, York
- 07/2019 “Higher structures in algebraic quantum field theory” at *Mathematics of interacting 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
- 11/2017 “Categorical techniques for NC geometry and gravity” at *Mathematical models for noncommutativity in physics and quantum spacetime*, Warsaw

- 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*, Mathematisches 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 geometry” 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: Deformation 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

Seminar talks

- 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 Mathematics 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 Mathématique, 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 -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 spacetimes”, Mathematical Physics Seminar, University of Vienna
- 01/2010 “Algebraic approach to quantum field theory on noncommutative curved spacetimes”, Mathematical Physics Seminar, University of Alessandria

Invited lectures

- 07/2023 LMS Undergraduate Summer School, University of Sheffield, UK. (5 one-hour lectures on “Interactions between algebra, geometry and quantum theory”, plus 2 one-hour exercise classes)
- 03/2023 Interactions between Poisson Geometry and Quantisation, University of Göttingen, Germany. (4 one-hour lectures on “Higher structures and quantization”)
- 09/2020 Higher Structures and Field Theory, Erwin Schrödinger Institute, Austria. (3 one-hour lectures on “Higher structures in algebraic quantum field theory”)
- 02/2013 NIMS Winter School for Quantum Gravity and Cosmology, Daejeon, South Korea. (4 one-hour lectures on “Noncommutative geometry and gravity”)

Seminar and workshop organization

- 09/2022 Organizer of the 4th AQFTUK meeting, University of Nottingham
- 12/2016 Organizer of the Mini-Workshop “New interactions between homotopical algebra and quantum field theory”, Mathematisches Forschungsinstitut Oberwolfach (MFO) — with M. Benini, K. Rejzner and C. Schweigert
- 08/2015-03/2016 Organizer of the Edinburgh Mathematical Physics Group (EMPG) Seminar
- 05/2013 Organizer of the 32nd Workshop “Foundations and Constructive Aspects of QFT”, University of Wuppertal — with H. Gottschalk

Teaching

At the University of Nottingham:

- 09/2023-05/2024 Quantum Field Theory
- 09/2022-05/2023 Quantum Field Theory
- 01/2022-05/2022 Relativity
- 01/2021-05/2021 Relativity
- 01/2020-05/2020 Relativity
- 01/2019-05/2019 Relativity
- 01/2018-05/2018 Relativity
- 01/2017-05/2017 Relativity

At the University of Regensburg:

- 04/2016-07/2016 Mathematical aspects of quantum field theory
- 04/2016-07/2016 Probability theory (tutorials)

At Heriot-Watt University, Edinburgh:

04/2014-03/2016 Due to the regulations of my Research Fellowship of the Deutsche Forschungsgemeinschaft (DFG) I was not permitted to teach during this period.

At the University of Wuppertal:

10/2013-02/2014 Geometric aspects of supergravity and string theory

10/2013-02/2014 Stochastics and probability theory (organization of the tutorials)

04/2013-07/2013 Applied statistics (organization of the tutorials)

04/2013-07/2013 \mathbb{Z}_2 -graded algebra and supergeometry

10/2012-02/2013 Stochastics and probability theory (organization of the tutorials)

04/2012-07/2012 Partial differential equations

10/2011-02/2012 Stochastics and probability theory (organization of the tutorials)

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

Additional activities

- ▷ Member of the Royal Society's International Exchanges Panel (since 01/2019).
- ▷ Grant proposal reviewer for various councils, including: Engineering and Physical Sciences Research Council (EPSRC, UK); Royal Society (UK); Marie Skłodowska 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.

Nottingham, December 8, 2023