

# Jens Niklas Eberhardt

---

## Curriculum Vitæ

---

### Areas of Interest

Geometric representation theory, geometric Langlands, motivic homotopy theory, algebraic geometry, knot theory, in particular representations of reductive groups and motivic sheaves. Further interests: quantum information theory.

---

### Personal

February 20th, 1991 Born in Düsseldorf, Germany  
Nationality German

---

### Employment

#### Academic

from Oct 2024 **Juniorprofessor**, *University of Mainz*  
Currently on leave for my research position

Oct 2024 - Sep 2025 **Postdoctoral fellow**, *University of Mainz*  
Research position funded by my grant “Equivariant  $K$ -motives and Koszul Duality”

Oct 2023 - Sep 2024 **Substitute professor**, *University of Bonn*  
Research and Teaching

Oct 2021 - Sep 2023 **Postdoctoral fellow**, *University of Wuppertal*  
Research position funded by my grant “Equivariant  $K$ -motives and Koszul Duality”

Oct 2020 - Sep 2021 **Postdoctoral fellow**, *University of Bonn*  
Research and four hours of teaching per week.

Jul 2019 - Sep 2020 **Postdoctoral fellow**, *Max Planck Institute for Mathematics Bonn*  
Research and organization of seminars.

Aug 2017 - Jun 2019 **Assistant Adjunct Professor**, *University of California Los Angeles*  
Research and instructing five lecture courses per year.

Aug 2014 - Aug 2017 **Doctoral Student**, *GK1821 “Cohomological Methods in Geometry”, Freiburg*  
Research and organization of seminars.

Oct 2011 - Apr 2014 **Teaching assistant**, *Lehrstuhl B für Mathematik, RWTH Aachen, Aachen, Germany*  
Instructing students in a computer algebra course.

#### Industry

from 2023 **Freelance Consultant**, for example for IQM (largest European company developing a quantum computer)  
Mathematical consulting.

Sep 2018 - May 2019 **Consultant Quantum Architect**, *PsiQ (company developing a general purpose silicon photonic quantum computer)*, Palo Alto, California  
Mathematical consulting.

---

### Awards and Grants

Jan 2021 **Research Grant**, *European Union*, “REMOLD - Representations, Motives and Langlands Duality ” (<https://remold.org>), funding volume €2,399,688

- Principal investigator for a MSCA Doctoral Network with nine PhD positions
- Mar 2023 **Indagationes Best Paper Prize**, *Royal Dutch Mathematical Society (KWG) and Elsevier*, “Motivic Springer Theory”, price amount €1,000  
Price for the best paper published in *Indagationes Mathematicae* in the past year.
- Mar 2023 **Workshop Grant**, *Heilbronn Institute for Mathematical Research (HIMR)*, “Geometric and Representation Theoretic Constructions of Expander Graphs”, funding volume £3,900  
Grant for a week-long research joint workshop in Bristol.
- Jan 2021 **Research Grant**, *German Research Foundation (DFG)*, “Equivariant  $K$ -motives and Koszul Duality”, funding volume €294,300  
Grant for my own research position for the duration of three years.
- May 2019 **Distinguished Teaching Award 2019**, *UCLA Department of Mathematics*  
Award for best math teaching at UCLA.
- 2015 **Springorum Denkmünze**, *RWTH Aachen*  
Award for best graduates at RWTH Aachen

---

## Education

- Aug 2014 – May 2017 **Dr. rer. nat.**, *Albert-Ludwigs-Universität Freiburg*  
Mathematics, grade “*summa cum laude*”, Advisor: *Wolfgang Soergel*
- Apr 2013 – Apr 2014 **Master of Science with honors**, *RWTH Aachen*  
Mathematics with minor computer science, grade “*sehr gut mit Auszeichnung*”, Advisor: *Wilhelm Plesken*
- Apr 2010 – Apr 2013 **Bachelor of Science**, *RWTH Aachen*  
Mathematics with minor computer science, grade “*sehr gut*”, Advisor: *Wilhelm Plesken*

---

## Publications

Published/Accepted

- Jan 2024  **$K$ -theory Soergel Bimodules**, *Jens Niklas Eberhardt, Bulletin of the London Mathematical Society*  
DOI:10.1112/blms.12987
- Jan 2023 **Integral Motivic Sheaves And Geometric Representation Theory**, *Jens Niklas Eberhardt, Jakob Scholbach, Advances in Mathematics*  
DOI:j.aim.2022.108811
- Apr 2022  **$K$ -Motives and Koszul Duality**, *Jens Niklas Eberhardt, Bulletin of the London Mathematical Society*  
DOI:10.1112/blms.12691
- Jan 2022 **Motivic Springer Theory**, *Jens Niklas Eberhardt, Catharina Stroppel, Indagationes Mathematicae*  
DOI:10.1016/j.indag.2021.11.004
- Jan 2022 **Group completion in the  $K$ -theory and Grothendieck–Witt theory of proto-exact categories**, *Jens Niklas Eberhardt, Oliver Lorscheid, Matthew B. Young, Journal of Pure and Applied Algebra*  
DOI:10.1016/j.jpaa.2022.107018
- Jan 2022 **Algebraic  $K$ -theory and Grothendieck–Witt theory of monoid schemes**, *Jens Niklas Eberhardt, Oliver Lorscheid, Matthew B. Young, Mathematische Zeitschrift*  
DOI:10.1007/s00209-021-02919-z
- Oct 2021 **Quantum Low-Density Parity-Check Codes**, *Nikolas Peter Breuckmann, Jens Niklas Eberhardt, PRX Quantum*  
DOI:10.1103/PRXQuantum.2.040101
- Jun 2021 **Balanced Product Quantum Codes**, *Nikolas Peter Breuckmann, Jens Niklas Eberhardt, IEEE Transactions on Information Theory*  
DOI:10.1109/TIT.2021.3097347

- Oct 2020 **Real Springer fibers and odd arc algebras**, Jens Niklas Eberhardt, Grégoire Naisse, Arik Wilbert, *Journal of the London Mathematical Society*  
DOI:10.1112/jlms.12413
- Jul 2020 **Springer Motives**, Jens Niklas Eberhardt, *Proceedings of the American Mathematical Society*  
DOI:10.1090/proc/15290
- Apr 2019 **Mixed Motives and Geometric Representation Theory in Equal Characteristic**, Jens Niklas Eberhardt, Shane Kelly, *Selecta Mathematica New Series. 25.2*  
DOI:10.1007/s00029-019-0475-x
- Sep 2014 **Computing the Tutte Polynomial of a Matroid from its Lattice of Cyclic Flats**, Jens Niklas Eberhardt, *Electronic Journal Of Combinatorics Volume 21, Issue 3*  
DOI:10.37236/4610

#### Preprints/Submitted

- Aug 2024 **Universal Koszul Duality for Kac-Moody Groups**, Jens Niklas Eberhardt, Arnaud Eteve  
arXiv:2408.14716
- Jul 2024 **Two proofs of a Jantzen Conjecture for Whittaker Modules**, Jens Niklas Eberhardt, Anna Romanov  
arXiv:2407.16330
- Jul 2024 **An Intersection Matrix for Affine Hyperplane Arrangements**, Jens Niklas Eberhardt, Carl Mautner  
arXiv:2407.06008
- Jul 2024 **Logical Operators and Fold-Transversal Gates of Bivariate Bicycle Codes**, Jens Niklas Eberhardt, Vincent Steffan  
arXiv:2407.03973
- Jan 2024 **K-motives, Springer Theory and the Local Langlands Correspondence**, Jens Niklas Eberhardt  
arXiv:2401.13052
- Oct 2023 **Standard Extension Algebras I: Perverse Sheaves and Fukaya Calculus**, Jens Niklas Eberhardt, Catharina Stroppel  
arXiv:2310.09206
- Mar 2016 **Graded and Geometric Parabolic Induction for Category  $\mathcal{O}$** , Jens Niklas Eberhardt  
arXiv:1603.00327

#### Other Publications

- May 2022 **Soergel and Springer: Motives and Correspondences**, Jens Niklas Eberhardt, *Oberwolfach Report*  
DOI:10.14760/OWR-2022-23
- Apr 2022 **Perverse Sheaves on Flag Varieties**, Jens Niklas Eberhardt, *Oberwolfach Report*  
DOI:10.14760/OWR-2022-18
- Jul 2020 **Challenges and issues of SARS-CoV-2 pool testing**, Jens Niklas Eberhardt, Nikolas Peter Breuckmann, Christiane Sigrid Eberhardt, *The Lancet Infectious Diseases*  
DOI:10.1016/s1473-3099(20)30467-9
- Jul 2020 **Multi-Stage Group Testing Improves Efficiency of Large-Scale COVID-19 Screening**, Jens Niklas Eberhardt, Nikolas Peter Breuckmann, Christiane Sigrid Eberhardt, *Journal of Clinical Virology, Volume 128*  
DOI:10.1016/j.jcv.2020.104382

---

#### Talks

##### Conferences

- Aug 2022 **A  $K$ -theoretic approach to geometric representation theory**, Conference "Building(s) in Aarhus", Aarhus University

- Jul 2022 *Soergel and Springer: Motives And Correspondences*, GK Colloquium, University of Freiburg
- Jun 2022 *Motivic Springer Theory*, Conference "Representation theory and Flag and Quiver Varieties", Université Paris Cité
- May 2022 *Motivic Springer Theory*, Workshop "Interactions between Algebraic Geometry and Noncommutative Algebra", Oberwolfach
- Sep 2021 *Motivic Springer Theory*, Conference "Representation theory's hidden motives", University of Münster and University of Sydney
- Jun 2020 *K-motives and Koszul duality*, Twinned conference "Geometric Representation Theory", Max Planck Institute in Bonn, Germany and Perimeter Institute in Waterloo, Canada
- Sep 2019 *Motives in (Modular) Representation Theory*, Clay workshop on "Modular representation theory", Oxford
- Oct 2016 *Six Operations Formalisms in Geometric Representation Theory*, Workshop "Kac-Moody Groups and L-Functions", University of Nottingham
- Jun 2014 *A New Algorithm for the Tutte Polynomial*, Workshop "Recent Methods in Sphere Packing and Optimization", Oberwolfach

#### Lecture Series

- Aug 2023 *Motives in Geometric Representation Theory*, Five lectures, Hong Kong University of Science and Technology

#### Seminars

- Oct 2024 *Sheaves on Stratified Spaces*, Seminar on Conformal Field Theory, FAU Erlangen
- Mar 2024 *Sheaves on Stratified Spaces*, Algebraic Geometry and Number Theory Seminar, IST Austria
- Feb 2024 *K-motives and Local Langlands*, Number Theory Seminar, University of Tokyo
- Feb 2023 *Hyperbolic Localization and Extension Algebras*, Algebra seminar, University of Freiburg
- Feb 2023 *A K-theoretic Approach to Geometric Representation Theory*, Algebra seminar, Free University of Brussels
- Jan 2023 *A K-theoretic Approach to Geometric Representation Theory*, Algebra/Topology seminar, University of Strasbourg
- Dec 2022 *Soergel and Springer: Motives And Correspondences*, Algebra Seminar, University of Virginia
- Nov 2022 *Soergel and Springer: Motives And Correspondences*, Algebra Seminar, University of Picardy
- May 2022 *Motivic Springer Theory*, Paris algebra seminar, Université Paris Cité
- Apr 2022 *Perverse Sheaves on Flag Varieties*, Arbeitsgemeinschaft, Oberwolfach
- Jan 2022 *Motivic Springer Theory*, University of Rome Tor Vergata
- Nov 2021 *Motivic Springer Theory*, University of Wuppertal
- Jun 2021 *Algebraic K-theory and Grothendieck–Witt theory in non-additive settings*, University of Bonn
- Mar 2021 *K-Motives and Koszul Duality in Geometric Representation Theory*, IAS Princeton
- Nov 2020 *Geometric Coding Theory*, University of Freiburg
- Jul 2020 *K-motives and Koszul duality*, University of Freiburg
- May 2020 *Motives in Geometric Representation Theory*, University of Münster
- Dec 2019 *Motives in Geometric Representation Theory*, RWTH Aachen University
- Oct 2019 *Motives in Geometric Representation Theory*, University of Kaiserslautern
- Oct 2019 *Motives in Geometric Representation Theory*, University of Bochum
- Oct 2018 *Category  $\mathcal{O}$  and Mixed Geometry*, University of Toronto
- Feb 2018 *Category  $\mathcal{O}$  and Mixed Geometry*, University of Southern California

- Feb 2018 *Category  $\mathcal{O}$  and Mixed Geometry*, UC Riverside
- Jun 2017 *Six Operations Formalisms in Geometric Representation Theory*, Univ. Clermont-Ferrand
- Aug 2016 *Graded Category  $\mathcal{O}$  and Motivic Six Operations*, Max-Planck-Institut für Mathematik, Bonn
- Oct 2016 *Category  $\mathcal{O}$  and Mixed Geometry*, GK-Kolloquium, Univ. of Regensburg
- May 2014 *The Tutte Polynomial of Highly Symmetrical Matroids*, Colloquium, RWTH Aachen
- Jul 2013 *Linearization of Matroid Automorphisms*, Summer School in Algorithmic Mathematics, Univ. of Hamburg

---

## Teaching Experience

### Lectures and Seminars

- Apr 2024 – Jul 2024 **Advanced Topics in Representation Theory - Kac-Moody Algebras and Flag Varieties**, *Bonn University*, Instructor
- Oct 2023 – Feb 2024 **Representation Theory II - Spaces In Geometric Representation Theory**, *Bonn University*, Instructor
- Oct 2020 – Feb 2021 **Seminar on Geometric Representation Theory of Weyl Groups**, *Bonn University*, Instructor
- Oct 2020 – Feb 2021 **Seminar on Real Reductive Groups**, *Bonn University*, Instructor
- Oct 2019 – Feb 2020 **Seminar on Hall Algebras**, *Bonn University*, Instructor
- Apr 2019 – Jun 2019 **Real Analysis**, *UCLA*, Instructor
- Jan 2019 – Mar 2019 **Differential and Integral Calculus**, *UCLA*, Instructor
- Jan 2019 – Mar 2019 **Linear Algebra Honors (115AH)**, *UCLA*, Instructor
- Jan 2019 – Mar 2019 **Differential and Integral Calculus**, *UCLA*, Instructor
- Sep 2018 – Dec 2018 **Linear Algebra Honors (115AH)**, *UCLA*, Instructor
- Sep 2018 – Dec 2018 **Differential and Integral Calculus (31A)**, *UCLA*, Instructor
- Apr 2018 – Jun 2018 **Linear Algebra (115A)**, *UCLA*, Instructor
- Apr 2018 – Jun 2018 **Differential and Integral Calculus (31A)**, *UCLA*, Instructor
- Jan 2018 – Mar 2018 **Introduction to Discrete Structures (61)**, *UCLA*, Instructor
- Sep 2017 – Dec 2017 **Differential and Integral Calculus (31A)**, *UCLA*, Instructor
- Sep 2017 – Dec 2017 **Linear Algebra (115A)**, *UCLA*, Instructor
- Oct 2016 – Feb 2017 **Seminar on  $SL_2$** , *University Freiburg*, Organizer
- Apr 2015 – Jul 2015 **Seminar on Sheaf cohomology**, *University Freiburg*, Organizer
- Oct 2011 - Apr 2014 **Teaching assistant**, *Lehrstuhl B für Mathematik, RWTH Aachen*, Aachen, Germany

### Students

- from 2024 **Renzhi Liang**, *University of Bonn*, Master Student, ‘Whittaker functors’
- from 2024 **Ori Bar Gendel**, *University of Bonn*, Master Student, ‘Extension of Verma modules’
- from 2022 **Luka Bizjak**, *Free University of Brussels*, Doctoral Student, ‘ $K$ -motives and toric varieties’
- 2022 – 2023 **Xiaoxiang Zhou**, *Bonn University*, Master Student, ‘Geometry of Quiver Flag Varieties’