

Research Interests

Arithmetic Geometry, Langlands Program, Geometric Representation Theory

Positions

- 2019 – present **Professor**, *Technical University of Darmstadt*, Germany
Parental leave 01/2023 – 07/2023
- 2018 – 2019 **PostDoc**, *Sorbonne Université*, Paris, France
With Laurent Fargues
- 2016 – 2018 **PostDoc**, *University of Duisburg-Essen*, Germany
With Jochen Heinloth
- 2014 – 2016 **Teach First Deutschland**, *Dreikönigsgymnasium*, Köln, Germany
Teaching mathematics and philosophy
- 2014 **PostDoc**, *Bonn University*, Germany
With Michael Rapoport

Education

- 2010 – 2014 **PhD in Mathematics**, *Bonn University*, Germany
Advisor: Michael Rapoport, defended 01/2014 (summa cum laude)
- 2006 – 2010 **Diploma in Mathematics**, *Bonn University*, Germany

Research visits

- 03/2019 **University of Maryland**, *College Park MD*, USA
- 06/2018 **École normale supérieure de Lyon**, *France*
- 03/2018 **University of Maryland**, *College Park MD*, USA
- 08/2016 – 09/2016 **Max Planck Institute for Mathematics**, *Bonn*, Germany
- 07/2013 **Mathematical Sciences Research Institute**, *Berkeley CA*, USA
- 02/2012 – 03/2012 **Fields Institute**, *Toronto*, Canada
- 09/2010 – 12/2010 **Harvard University**, *Cambridge MA*, USA
- 01/2010 – 03/2010 **Institut Henri Poincaré**, *Paris*, France

Awards & Grants

- 2025 – 2028 **Marie Curie Doctoral Network**, *ReMoLD*, PI in 1 subproject
- 2022 – 2028 **LOEWE Professorship**, *Algebra*, PI
- 2022 – 2027 **ERC Starting Grant**, *MotLang*, PI
- 2021 – 2025 **Collaborative Research Center**, *326 GAUS*, PI in 2 subprojects
- 2021 – 2026 **ERC Consolidator Grant**, *RedLang*, Partner of Simon Riche
- 2018 **Deutsche Forschungsgemeinschaft**, *PostDoc scholarship*
- 2010 – 2013 **Max-Planck Gesellschaft**, *PhD scholarship*
- 2008 – 2010 **Studienstiftung des Deutschen Volkes**, *scholarship*

Publications

Published/accepted

Singularities of local models, **Mathematische Annalen** 391 (2025), 6205–6250 (with Najmuddin Fakhruddin, Tom Haines, João Lourenço)

Frobenius Rigidity in $\mathbb{A}^1$ -homotopy theory, **Documenta Mathematica** 30 (2025), 219-244 (with Jakob Scholbach)

On the normality of Schubert varieties: Remaining cases of positive characteristic, **Annales scientifiques de l'École normale supérieure** 57 (2024), 895-959 (with Tom Haines, João Lourenço)

A categorical Künneth formula for constructible Weil sheaves, **Algebra & Number theory** 18 (2024), 499-536 (with Tamir Hemo, Jakob Scholbach)

Constructible sheaves on schemes, **Advances in Mathematics** 429 (2023), 109-179 (with Tamir Hemo, Jakob Scholbach)

Néron blowups and low-degree cohomological applications, **Algebraic Geometry** 10 (2023), 729-753 (with Arnaud Mayeux, Matthieu Romgany)

Normality and Cohen-Macaulayness of Parahoric Local Models, **Journal of the European Mathematical Society** 25 (2023), 703-729 (with Tom Haines)

Tate motives on Witt vector affine flag varieties, **Selecta Mathematica** 27 (2021), 1-34 (with Jakob Scholbach)

The motivic Satake equivalence, **Mathematische Annalen** 380 (2021), 1595-1653 (with Jakob Scholbach)

The Test Function Conjecture for Parahoric Local Models, **Journal of the American Mathematical Society** 34 (2021), 135-218 (with Tom Haines)

Smoothness of Schubert varieties in twisted affine Grassmannians, **Duke Mathematical Journal** 169 (2020), 3223-3260 (with Tom Haines)

The Test Function Conjecture for Local Models of Weil-restricted groups, **Compositio Mathematica**, 156 (2020), 1348-1404 (with Tom Haines)

The intersection motive of the moduli stack of shtukas, **Forum of Mathematics, Sigma** 8 (2020), 1-99 (with Jakob Scholbach)

Spaces with $\mathbb{G}_m$ -action, hyperbolic localization and nearby cycles, **Journal of Algebraic Geometry** 28 (2019), 251-289

On the Iwahori-Weyl Group, **Bulletin de la Société mathématique de France** 144 (2016), 117-124

Affine Grassmannians and Geometric Satake Equivalences, **International Mathematics Research Notices** 12 (2016), 3717-3767

Appendix to Xinwen Zhu: *The Geometrical Satake Correspondence for Ramified Groups*, **Annales scientifiques de l'École normale supérieure** 48 (2015), 409-451 (with Xinwen Zhu)

A new approach to the Geometric Satake Equivalence, **Documenta Mathematica** 19 (2014), 209-246

Schubert Varieties in Twisted Affine Flag Varieties and Local Models, **Journal of Algebra** 375 (2013), 121-147

Preprints on arXiv

Categorical Künneth formulas for cohomological motives, arXiv:2503.14416, 30 pages (with Jakob Scholbach)

A modular ramified geometric Satake equivalence, arXiv:2403.10651, 79 pages (with Pramod Achar, João Lourenço, Simon Riche)

Normality of Schubert varieties in affine Grassmannians, arXiv:2312.11154, 14 pages (with Patrick Bieker)

Fixed points under pinning-preserving automorphisms of reductive group schemes, arXiv:2212.10182, 36 pages (with Pramod Achar, João Lourenço, Simon Riche)

On the p -adic theory of local models, arxiv:2201.01234, 53 pages (with Johannes Anschütz, Ian Gleason, João Lourenço)

Proceedings

Categorical Künneth formula for Weil sheaves, Automorphic Forms, Geometry and Arithmetic, Oberwolfach Reports (2021)

Non-normality of Schubert varieties, Algebraic Groups, Oberwolfach Reports (2021)

Cohen-Macaulayness of local models, Arithmetic Geometry, Oberwolfach Reports (2020)

The test function conjecture for parahoric local models, Arithmetic of Shimura varieties, Oberwolfach Reports (2019)

The stack Bun and Hecke stacks, Arbeitsgemeinschaft: Higher Gross-Zagier Formulas, Oberwolfach Reports (2017)

Affine Grassmannians and Geometric Satake Equivalences, Langlands correspondence and constructive Galois theory, Oberwolfach Reports (2014)

Professional activities

Refereeing & Quick opinion

Inventiones Mathematicae, *Duke Mathematical Journal*, *Crelle's Journal*, *Forum of Mathematics Pi*, *Annales scientifiques de l'École normale supérieure*, *Selecta Mathematica*, *Compositio Mathematica*, *Journal of the Institute of Mathematics of Jussieu*, *Mathematische Annalen*, *Journal de l'École polytechnique*, *Journal of Algebraic Geometry*, *Representation Theory*, *Algebra & Number Theory*, *Forum of Mathematics Sigma*, *International Mathematics Research Notices*, *Bulletin of the London Mathematical Society*

Organization of scientific meetings

- 08/2025 *Motives and Arithmetic Geometry*, Darmstadt (with Tom Bachmann, Sabrina Pauli, Fabio Tanania)
- 07/2025 *Geometry and Representation Theory around the Langlands program*, Clermont Ferrand (with Gabriel Dospinescu, Abel Lacabanne, Simon Riche)
- 10/2024 *Reduction of Arithmetic Varieties*, Oberwolfach (with Tom Haines, Eva Viehmann, Torsten Wedhorn)
- 08/2024 *Ramification in geometric Langlands and non-abelian Hodge theory*, Heidelberg (with Andreas Hohl, Johannes Horn, Konstantin Jakob, Judith Ludwig)
- 10/2023 *Geometric and categorical representation theory*, Besse (with Abel Lacabanne, Simon Riche)
- 10/2023 *Arithmetic Algebraic Geometry*, Münster (with Hellmann, Mihatsch, Viehmann)
- 03/2023 *Condensed Mathematics*, Luminy (with Arthur-César Le Bras, Sophie Morel, Vincent Pilloni)
- 10/2022 *Arithmetic Algebraic Geometry*, Darmstadt (with Ulrich Görtz, Torsten Wedhorn)
- 09/2022 *Women in Arithmetic Geometry*, Heidelberg (with Katharina Hübner, Holly Krieger)
- 01/2022 *Workshop on geometric Satake*, Clermont-Ferrand (with Arnaud Mayeux, Simon Riche)
- 07/2021 *Ruth Moufang Lectures* (with Martin Ulirsch, Otmar Venjakob)
- 02/2019 *Workshop on ∞ -categories*, Darmstadt (with Torsten Wedhorn)

Seminar presentations (selection)

- 2012 – present *Free University of Berlin*, *Institute of Science and Technology Austria*, *Goethe University Frankfurt*, *Heinrich Heine University Düsseldorf*, *University of Regensburg*, *Gutenberg University Mainz*, *University of Wuppertal*, *LMU Munich*, *RAMPAGE Seminar*, *Harvard University*, *Leibniz University Hannover*, *University of Duisburg-Essen*, *ENS Lyon*, *HUJI-BGU AGNT Seminar*, *POINTS Seminar Beijing*, *University of Paris 13*, *MPIM Bonn*, *Orsay*, *EPF Lausanne*, *TU Munich*, *IMJ Paris*, *LSU Baton Rouge*, *University of Maryland*, *Université Clermont Auvergne*, *University of Caen*, *Imperial College London*, *Heidelberg University*, *University of Strasbourg*, *University of Bayreuth*, *Paderborn University*, *Fields Institute Toronto*

Conference presentations

2014 – present *Anabelian and motivic homotopy theory* (Heidelberg), *Representation Theory at Lyon*, *AMS-SMF-EMS joint meeting* (Grenoble), *Motives and Representation Theory* (Münster), *Six Functor Formalism and Motivic Homotopy Theory* (Milano), *Automorphic Forms, Geometry and Arithmetic* (Oberwolfach), *Algebraic Groups* (Oberwolfach), *Arithmetic Geometry* (Oberwolfach), *Modularity and Moduli spaces* (Oaxaca), *L-Functions and Geometric Representation Theory* (Island of Nisyros), *Shimura varieties, representation theory and related topics* (Hokkaido University), *Buildings and affine Grassmannians* (CIRM), *Arithmetic Geometry in Carthage* (Tunisia), *Arithmetic of Shimura Varieties* (Oberwolfach), *Conference on the occasion of Michael Rapoport's 70th birthday* (Bonn), *Groupes algébriques et géométrisation du programme de Langlands* (Lyon), *DMV Tagung* (Paderborn), *Higher Gross-Zagier formulas* (Oberwolfach), *Langlands correspondence and constructive Galois theory* (Oberwolfach)

Committee work & Academic self-governance

04/2024 – present *'Coffee & π ' seminar coffee series*, Department of Mathematics, Technical University of Darmstadt (with Moritz Egert)

10/2023 – present *Acquisition of third-party funding*, Department of Mathematics, Technical University of Darmstadt (with Pascal Schweitzer)

10/2022 – present *Promotionsausschuss*, Department of Mathematics, Technical University of Darmstadt

10/2023 – 09/2024 *Spokesperson of the Working Group Algebra*, Technical University of Darmstadt

01/2023 – 08/2023 *Professorship W1 – Algebra and Geometry*, Chair of the appointment committee, Technical University of Darmstadt

Team members

PostDocs

04/2024 – present Chirantan Chowdhury

06/2023 – present Fabio Tanania

09/2022 – present Konstantin Jakob

PhDs

05/2023 – present Paul Siemon

03/2022 – present Rızacan Çiloğlu

10/2021 – present Thibaud van den Hove

04/2019 – 03/2023 Patrick Bieker, *Integral models of moduli spaces of shtukas with deep level structures*, awarded best PhD thesis in mathematics at Technical University of Darmstadt in 2022

Master students

12/2022 – 05/2023 Varun Kumar, *Minimal degeneration singularities in the affine Grassmannian for $PGL_{2,\mathbb{Z}}$*

05/2022 – 11/2022 Helena Kuhr, *Arc descent for constructible adic sheaves*

04/2022 – 10/2022 Benedikt Müller, *Drinfeld's lemma for schemes*

Bachelor students

11/2023 – 04/2024 Moritz Reinhard, *Unendliche Galoistheorie*

Teaching experience

Lectures

summer 2025 *Algebraic Geometry 1*, Technical University of Darmstadt (with Sabrina Pauli)

summer 2024 *Algebraic Number Theory*, Technical University of Darmstadt

winter 2023/24 *Intersection Theory*, Technical University of Darmstadt

winter 2021/22 *Algebraic Geometry II*, Technical University of Darmstadt (with Yingkun Li)

summer 2021 *Einführung in die Algebra*, Technical University of Darmstadt

winter 2020/21 *Introduction to the Langlands program*, Technical University of Darmstadt

summer 2020 *Galois cohomology*, Technical University of Darmstadt

winter 2019/20 *Algebraic Geometry II*, Technical University of Darmstadt (with Torsten Wedhorn)

summer 2019 *Weil Conjectures*, Technical University of Darmstadt

summer 2019 *Algebraic Geometry I*, Technical University of Darmstadt

winter 2018/19 *Pro-étale cohomology*, Technical University of Darmstadt (with Torsten Wedhorn)

- winter 2017/18 *Didaktik der Linearen Algebra und Analytischen Geometrie*, University of Duisburg-Essen
 summer 2017 *Figuren und Abbildungen im Geometrieunterricht*, University of Duisburg-Essen
 winter 2016/17 *Didaktik der Linearen Algebra und Analytischen Geometrie*, University of Duisburg-Essen
- ### Seminars
- winter 2023/24 – present *Seminar on Arithmetic Geometry*, Technical University of Darmstadt (with Sabrina Pauli, Torsten Wedhorn)
 summer 2025 *Categorical Deligne-Langlands correspondence*, Technical University of Darmstadt (with Rıżacan ilođlu, Torsten Wedhorn)
 winter 2024/25 *Vector bundles on curves*, Technical University of Darmstadt (with Torsten Wedhorn)
 summer 2024 *Chromatic homotopy theory*, Technical University of Darmstadt & Gutenberg University Mainz (with Georg Tamme)
 winter 2023/24 *Rigid analytic motives*, Technical University of Darmstadt & Goethe University Frankfurt (with Rıżacan ilođlu, Lucas Gerth, Jon Miles)
 winter 2022/23 *Seminar on Arithmetic Geometry*, Technical University of Darmstadt (with Torsten Wedhorn)
 summer 2022 *Étale motives*, Technical University of Darmstadt (with Rıżacan ilođlu, Thibaud van den Hove)
 winter 2020/21 *Condensed Mathematics*, Technical University of Darmstadt & Goethe University Frankfurt (with Torsten Wedhorn)
 summer 2020 *Homological Algebra and Sheaves*, Technical University of Darmstadt & Goethe University Frankfurt (with Torsten Wedhorn)
 winter 2018/19 *Prismatic cohomology*, Institut de Mathématiques de Jussieu (with Ariane Mezard)
 winter 2017/18 *The Fargues-Fontaine curve*, University of Duisburg-Essen
 winter 2017/18 *Forschungsseminar Arithmetische Geometrie*, University of Duisburg-Essen
 winter 2017/18 *Seminar on Stacks*, University of Duisburg-Essen (with Jochen Heinloth)
 summer 2017 *Forschungsseminar Arithmetische Geometrie*, University of Duisburg-Essen
 winter 2016/17 *Forschungsseminar Arithmetische Geometrie*, University of Duisburg-Essen (with Michael Wong)
 summer 2011 *The unramified Drinfeld-Langlands Correspondence*, University of Bonn
- ### Assistance & Tutorials
- winter 2012/13 – winter 2013/14 Assistant for Michael Rapoport’s lectures *Einführung in die Algebra, Algebra I, Algebra II*, Bonn University
 summer 2007 – winter 2010/11 Tutor for lectures in *Topology, Algebra, Complex Geometry, Linear Algebra and Analysis*, Bonn University

Other Publications

Brennpunkt Rechenschwäche, Mathematik lehren 201 (2017), Themenheft Inklusion (with Ulf Grebe)

Update: April 28, 2025