

# Timo Richarz

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## Research Interests

Arithmetic Algebraic Geometry, Langlands program, Moduli spaces of bundles, Geometric Representation Theory

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## Positions

- 2019–25 **Professor (W1)**, *Technische Universität Darmstadt*, Germany.
- 2018–19 **Postdoc**, *Sorbonne Université*, Paris, France.  
Research group of Laurent Fargues
- 2016–18 **Wiss. Mitarbeiter**, *University of Duisburg-Essen*, Germany.  
Research group of Jochen Heinloth
- 2014–16 **Fellow for Teach First Deutschland**, *Dreikönigsgymnasium*, Köln, Germany.  
Teaching mathematics and philosophy
- 2014 **Wiss. Mitarbeiter**, *Bonn University*, Germany.  
Research group of Michael Rapoport

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## Studies

- 2010–14 **PhD Studies Mathematics**, *Bonn University*, Germany.  
Advisor: Michael Rapoport, defended 30.01.2014 (summa cum laude)  
Title: *Affine Grassmannians and Geometric Satake Equivalences*
- 2006–10 **Diploma in Mathematics**, *Bonn University*, Germany.  
Advisor: Michael Rapoport, defended 21.07.2010

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## Research Visits

- Mar 2019 **University of Maryland**, *Invitation by T. J. Haines*, College Park MD, USA.
- Jun 2018 **École normale supérieure de Lyon**, *Groupes algébriques et géométrisation du programme de Langlands*, Lyon, France.
- Mar 2018 **University of Maryland**, *Invitation by T. J. Haines*, College Park MD, USA.
- Aug–Sep 2016 **Max-Planck Institut für Mathematik**, *Gastaufenthalt*, Bonn, Germany.
- Jul 2013 **Mathematical Sciences Research Institute**, *Fellow visitor of Peter Scholze*, Berkeley CA, USA.
- Feb–Mar 2012 **Fields Institute**, *Thematic Program on Galois Representations*, Toronto, Canada.
- Sep–Dec 2010 **Harvard University**, *Fellow visitor of Michael Rapoport*, Cambridge MA, USA.
- Jan–Mar 2010 **Institut Henri Poincaré**, *Galois trimester*, Paris, France.

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## Funds

- 2018 Scholarship, *Deutsche Forschungsgemeinschaft*, Forschungsstipendium.
- 2010–13 Scholarship, *Max-Planck Gesellschaft*, Promotionsstipendium.
- 2008–10 Scholarship, *Studienstiftung des Deutschen Volkes*.

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## PhD students

Patrick Bieker, started April 2019.

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## Refereed Publications (published/accepted)

Thomas J. Haines, Timo Richarz, *Normality and Cohen-Macaulayness of Parahoric Local Models*, arXiv:1903.10585, accepted in **Journal of the European Mathematical Society**.

Thomas J. Haines, Timo Richarz, *The Test Function Conjecture for Parahoric Local Models*, **Journal of the American Mathematical Society** 34 (2021), 135-218.

Thomas J. Haines, Timo Richarz, *Smoothness of Schubert varieties in twisted affine Grassmannians*, **Duke Math. Journal** 169 (2020), 3223-3260.

Thomas J. Haines, Timo Richarz, *The Test Function Conjecture for Local Models of Weil-restricted groups*, **Compositio Mathematica**, 156 (2020), 1348-1404.

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

Timo Richarz, *Spaces with  $\mathbb{G}_m$ -action, hyperbolic localization and nearby cycles*, **J. Algebraic Geom.** 28 (2019), 251-289.

Timo Richarz, *On the Iwahori-Weyl Group*, **Bulletin de la SMF** 144 (2016), 117- 124.

Timo Richarz, *Affine Grassmannians and Geometric Satake Equivalences*, **Int. Math. Res. Not.** 12 (2016), 3717-3767.

Timo Richarz, Xinwen Zhu, Appendix to Xinwen Zhu: *The Geometrical Satake Correspondence for Ramified Groups*, **Annales scientifiques de l'ENS** 48 (2015), 409-451.

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

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

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## Preprints

Timo Richarz, Jakob Scholbach, *The motivic Satake equivalence*, arXiv:1909.08322, 35 pages.

Arnaud Mayeux, Timo Richarz, Matthieu Romgany, *Néron blowups and low-degree cohomological applications*, arXiv:2001.03597, 22 pages.

Timo Richarz, Jakob Scholbach, *Tate motives on Witt vector affine flag varieties*, arXiv:2003.02593, 23 pages.

Thomas J. Haines, João N. P. Lourenço, Timo Richarz, *On the normality of Schubert varieties: Remaining cases of positive characteristic*, arXiv:1806.11001, 46 pages.

Timo Richarz, Jakob Scholbach, *A categorical Künneth formula for constructible étale sheaves*, arxiv.org/abs/2012.02853, 14 pages.

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## Proceedings

Timo Richarz, *Cohen-Macaulayness of local models*, Arithmetic Geometry, Oberwolfach Reports (2020).

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

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

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

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## Invited Lectures

- Sep 2019 *Basic geometry of affine Grassmannians*, 6h, Research School on *Buildings and affine Grassmannians*, CIRM, Luminy.
- Oct 2018 *The geometric Satake isomorphism*, 3h, London Number Theory Study group, Imperial College, London.

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## Conference Talks

- Jul 2021 *t.b.a.*, AMS-SMF-EMS joint meeting, Grenoble.
- Apr 2021 *t.b.a.*, Algebraic Groups, MFO.
- Mar 2021 *t.b.a.*, IMU-DMV Meeting, Hebrew University, Israel.  
cancelled due to Covid
- Jul 2020 *Cohen-Macaulayness of local models*, Arithmetic Geometry, MFO.
- Oct 2019 *Singularities in the reduction modulo  $p$  of Shimura varieties*, Modularity and Moduli spaces, Oaxaca, Mexico.
- Jul 2019 *The motivic Satake equivalence*, L-Functions and Geometric Representation Theory, Island of Nisyros, Greece.
- Jul 2019 *Cohen-Macaulayness of parahoric local models*, Shimura varieties, representation theory and related topics, Hokkaido University, Japan.
- Jun 2019 *Cohen-Macaulayness of parahoric local models*, Arithmetic Geometry in Carthage, Tunisian Academy Beit al-Hikma, Tunisia.
- Jan 2019 *The test function conjecture for parahoric local models*, Arithmetic of Shimura Varieties, Workshop MFO.
- Oct 2018 *Smoothness of Schubert varieties in twisted affine Grassmannians*, Conference on the occasion of Michael Rapoport's 70th birthday, Bonn University.
- Jun 2018 *The test function conjecture for parahoric local models*, Groupes algébriques et géométrisation du programme de Langlands, ENS Lyon.
- Mar 2018 *Spaces with  $\mathbb{G}_m$ -actions and applications*, DMV Tagung, University of Paderborn.
- Apr 2017 *The stack Bun and Hecke stacks*, Higher Gross-Zagier formulas, Arbeitsgemeinschaft MFO.
- Feb 2014 *Ramified geometric Satake isomorphisms*, Langlands correspondence and constructive Galois theory, Workshop MFO.

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## Seminar Talks

- Apr 2021 *t.b.a.*, Harvard number theory seminar.
- Dec 2020 *Reduktion von Shimura-Varietäten*, Leibniz Universität Hannover, online.
- Sep 2020 *Reduktion von Shimura-Varietäten*, LMU Munich.
- Jul 2020 *Reduktion von Shimura-Varietäten*, University of Mainz, online.
- Jun 2020 *Motivische Methoden im Langlandsprogramm*, University of Duisburg-Essen, online.
- Jun 2020 *The motivic Satake equivalence*, Séminaire TN, Lyon, online.
- May 2020 *The motivic Satake equivalence*, HUJI-BGU AGNT seminar, Israel, online.
- May 2020 *Néron blowups and integral models of shtuka spaces*, POINTS seminar, Beijing, China, online.
- Jan 2020 *The motivic Satake equivalence*, Séminaires de Géométrie Arithmétique et Motivique, Université Paris 13.
- Dec 2019 *Geometry in the reduction modulo  $p$  of Shimura varieties*, Max-Planck-Institut, Bonn.
- Dec 2019 *The motivic Satake equivalence*, SAGA, Département de Mathématiques d'Orsay.
- Nov 2019 *Smoothness of Schubert varieties in affine Grassmannians*, Seminar, École Polytechnique Fédérale de Lausanne.
- Nov 2019 *The motivic Satake equivalence*, Forschungsseminar Arithmetische Geometrie, Technische Universität München.

- Jul 2019 *Geometry in the reduction modulo  $p$  of Shimura varieties*, Workshop of the GRK 2240, Bergische Universität Wuppertal.
- May 2019 *The intersection motive of the moduli stack of shtukas*, Séminaire Autour des cycles algébriques, IMJ, Paris.
- Mar 2019 *Smoothness of Schubert varieties in affine Grassmannians*, Algebra and Number Theory Seminar, Louisiana State University.
- Mar 2019 *The intersection motive of the moduli stack of shtukas*, Algebra and Number Theory Seminar, University of Maryland.
- Dec 2018 *Smoothness of Schubert varieties in affine Grassmannians*, Séminaire, Université Clermont Auvergne.
- Nov 2018 *The test function conjecture for parahoric local models*, Séminaire de théorie des nombres, Université de Caen.
- Oct 2018 *Motivic Satake Equivalence*, Seminar, Universität Heidelberg.
- May 2018 *The geometric Satake isomorphism over non-algebraically closed fields*, Séminaire Quantique, Université de Strasbourg.
- Sep 2017 *The test function conjecture for parahoric local models*, Séminaire d'arithmétique à Lyon, ENS Lyon.
- Feb 2017 *Spaces with  $\mathbb{G}_m$ -actions and applications*, Seminar des Sonderforschungsbereichs "Higher Invariants", University of Regensburg.
- Jan 2017 *Spaces with  $\mathbb{G}_m$ -actions and applications*, Mittagsseminar zur Arithmetik, University of Münster.
- May 2014 *The geometric Satake isomorphism*, Oberseminar zur Arithmetischen Geometrie, University of Bayreuth.
- Nov 2012 *On the geometric Satake isomorphism*, Arbeitsgemeinschaft Arithmetische Geometrie, University of Paderborn.
- Nov 2012 *On the geometric Satake isomorphism*, Forschungsseminar Arithmetische Geometrie, University of Duisburg-Essen.
- Nov 2012 *Schubert varieties in twisted affine flag varieties*, Oberseminar Darstellungstheorie, Bergische Universität Wuppertal.
- Mar 2012 *On the geometric Satake isomorphism*, Thematic Program on Galois Representations, Fields Institute Toronto.

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## Teaching Experience

### Lecture Courses

- SS 21 *Einführung in die Algebra*, TU Darmstadt.
- WS 20/21 *Introduction to the Langlands program*, TU Darmstadt.
- SS 20 *Galois cohomology*, TU Darmstadt.
- WS 19/20 *Algebraic Geometry II*, TU Darmstadt, joint with Torsten Wedhorn.
- SS 19 *Weil Conjectures*, TU Darmstadt.
- SS 19 *Algebraic Geometry I*, TU Darmstadt.
- WS 18/19 *Pro-étale cohomology*, TU Darmstadt, joint with Torsten Wedhorn.
- WS 17/18 *Didaktik der Linearen Algebra und Analytischen Geometrie*, University of Duisburg-Essen.
- SS 17 *Figuren und Abbildungen im Geometrieunterricht*, University of Duisburg-Essen.
- WS 16/17 *Didaktik der Linearen Algebra und Analytischen Geometrie*, University of Duisburg-Essen.

### Seminars

- WS 20/21 *Condensed Mathematics*, TU Darmstadt/Universität Frankfurt, joint with Torsten Wedhorn.
- SS 20 *Homological Algebra and Sheaves*, TU Darmstadt/Universität Frankfurt, joint with Torsten Wedhorn.
- WS 18/19 *Prismatic cohomology*, Institut de Mathématiques de Jussieu, joint with Ariane Mezard.

- WS 17/18 *The Fargues-Fontaine curve*, University of Duisburg-Essen.  
WS 17/18 *Seminar on Stacks*, University of Duisburg-Essen, joint with Jochen Heinloth.  
WS 16–WS17 *Forschungsseminar Arithmetische Geometrie*, University of Duisburg-Essen, WS16 joint with Michael Wong.  
SS 11 *The unramified Drinfeld-Langlands Correspondence*, University of Bonn.  
Assistency  
WS 13/14 Michael Rapoport, *Algebra II*, University of Bonn.  
SS 13 Michael Rapoport, *Algebra I*, University of Bonn.  
WS 12/13 Michael Rapoport, *Einführung in die Algebra*, University of Bonn.  
Tutorials  
Prepared and held tutorials for students.  
SS 07–WS 10 Courses in *Topology, Algebra, Complex Geometry, Linear Algebra and Analysis*.

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## Other Publications

Ulf Grebe, Timo Richarz, *Brennpunkt Rechenschwäche*, Mathematik lehren 201 (2017), Themenheft Inklusion.

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## Further Activities

Languages German (Native), English (Fluent), French (Basic), Latinum

Referee A'ENS, Selecta, Compositio, JIMJ, JEP, J. Algebraic Geom., RT, ANT, Sigma, IMRN

Update: February 1, 2021