

Brandon Williams

CONTACT INFORMATION	RWTH Aachen Lehrstuhl A für Mathematik Templergraben 55, 52062 Aachen	<i>E-mail:</i> brandon.williams@matha.rwth-aachen.de <i>WWW:</i> btw-47.github.io
RESEARCH INTERESTS	Modular forms and their generalizations, including vector-valued modular forms, Jacobi forms, mock modular forms and automorphic forms on more general groups.	
EDUCATION	University of California, Berkeley, CA	
	Ph.D., Mathematics	2013-2018
	<ul style="list-style-type: none">• Dissertation title: <i>Computing modular forms for the Weil representation</i>• Adviser: Prof. Richard Borcherds• Area of Study: Automorphic forms	
	Ruprecht-Karls-Universität Heidelberg, Germany	
	M.Sc., Mathematics	2011-2013
	<ul style="list-style-type: none">• Thesis title: <i>On elliptic curves with complex multiplication, L-functions, and p-adic interpolation</i>• Adviser: Prof. Dr. Otmar Venjakob	
	B.Sc., Mathematics	2009-2011
	<ul style="list-style-type: none">• Thesis title: <i>GARCH(1,1)-models</i>• Adviser: Prof. Dr. Rainer Dahlhaus	
EMPLOYMENT	RWTH Aachen, Germany	
	Postdoctoral researcher	2020-present
	<ul style="list-style-type: none">• Postdoc mentor: Prof. Dr. Aloys Krieg	
	Technische Universität Darmstadt, Germany	
	Postdoctoral researcher	2018-2020
	<ul style="list-style-type: none">• Postdoc mentor: Prof. Dr. Jan Bruinier	
AWARDS	<ul style="list-style-type: none">• 2018 Ken Ribet – Lisa Goldberg Award in Algebra (department dissertation award)• Lehmer Fellowship in Number Theory, Spring 2018.	
PUBLICATIONS	<ul style="list-style-type: none">[1] Williams, B. <i>Poincaré square series for the Weil representation</i>. Ramanujan J. 47 (2018), no. 3, 605–650.[2] Williams, B. <i>Vector-valued Hirzebruch–Zagier series and class number sums</i>. Res. Math. Sci. 5 (2018), no. 2, Paper No. 25, 13 pp.[3] Williams, B. <i>Rankin–Cohen brackets and Serre derivatives as Poincaré series</i>. Res. Number Theory 4 (2018), no. 4, Art. 37, 13 pp.[4] Williams, B. <i>Vector-valued Eisenstein series of small weight</i>, Int. J. Number Theory 15 (2019), no. 2, 265–287.	

- [5] Williams, B. *Poincaré square series of small weight*. Ramanujan J. 48 (2019), no. 3, 585–612.
- [6] Williams, B. *Overpartition M_2 -rank differences, class number relations, and vector-valued mock Eisenstein series*. Acta Arith. 189 (2019), no. 4, 347–365.
- [7] Pribitkin, W. and Williams, B. *Short proof of Rademacher’s formula for partitions*. Res. Number Theory 5 (2019), no. 2, Art. 17, 6 pp.
- [8] Williams, B. *Remarks on the theta decomposition of vector-valued Jacobi forms*, J. Number Theory 197 (2019), 250–267.
- [9] Schwagenscheidt, M. and Williams, B. *Twisted component sums of vector-valued modular forms*, Abh. Math. Sem. Univ. Hamburg 89 (2019), no. 2, 151–168.
- [10] Williams, B. *A construction of antisymmetric modular forms for Weil representations*, Math. Zeitschrift 296 (2020) 391–408.
- [11] Williams, B. *Graded rings of paramodular forms of level 5 and 7*, J. Number Theory 209 (2020) 483–515.
- [12] Williams, B. *The rings of Hilbert modular forms for $Q(\sqrt{29})$ and $Q(\sqrt{37})$* , J. Algebra 559 (2020) 679–711.
- [13] Wang, H. and Williams, B. *On some free algebras of orthogonal modular forms*, Adv. Math. 373 (2020), Article 107332.
- [14] Williams, B. *Higher pullbacks of modular forms on orthogonal groups*, Forum Math. 33 (2021), 631–652.
- [15] Wang, H. and Williams, B. *Borcherds products of half-integral weight*, J. Number Theory 238 (2022), 944–950.
- [16] Williams, B. *Two graded rings of Hermitian modular forms*, Abh. Math. Sem. Univ. Hamburg 91 (2021) 257–285.
- [17] Wang, H. and Williams, B. *Graded rings of Hermitian modular forms with singularities*, Manuscripta Math. 170 (2023) 283–311.
- [18] Wang, H. and Williams, B. *Siegel modular forms of degree two and level five*, Ramanujan J. 60 (2023) 597–613.
- [19] Hauffe-Waschbüsch, A. and Krieg, A. and Williams, B. *On Hermitian Eisenstein series of degree 2*, Funct. Approx. 68(1) (2023), 127–141.
- [20] Wang, H. and Williams, B. *Projective spaces as orthogonal modular varieties*, Transform. Groups, in press.
- [21] Wang, H. and Williams, B. *Simple lattices and free algebras of modular forms*, Adv. Math. 413 (2023), Article 108835.
- [22] Schwagenscheidt, M. and Williams, B. *Binary theta functions and Borcherds products*, J. Number Theory 249 (2023) 441–461.
- [23] Wang, H. and Williams, B. *On weak Jacobi forms of rank two*, J. Algebra, in press.
- [24] Wang, H. and Williams, B. *Modular forms with poles on hyperplane arrangements*, Algebraic Geom., in press.

SUBMITTED
PREPRINTS

- [25] Wang, H. and Williams, B. *Free algebras of modular forms on ball quotients*, 2021, arXiv:2105.14892
- [26] Wang, H. and Williams, B. *The fake monster algebra and singular Borcherds products*, 2022, arXiv:2207.14518
- [27] Wang, H. and Williams, B. *Mathieu moonshine and Borcherds products*, 2022, arXiv:2208.00574
- [28] Wang, H. and Williams, B. *On the non-existence of singular Borcherds products*, 2023, arXiv:2301.13367
- [29] Wang, H. and Williams, B. *Automorphic products that are singular modulo primes*, 2023, arxiv:2307.14222

CONFERENCES AND
SEMINARS

- *Poincaré square series for the Weil representation* in *Trends in modular forms*, Daejeon, South Korea, December 19-22, 2017.
- *Computing obstruction spaces for Borcherds products* in ABKLS seminar, Aachen, Germany, February 14, 2018.
- *Vector-valued Hirzebruch-Zagier series and class number sums* in Emory University Algebra and Number Theory Seminar, April 17, 2018.
- *Class number sums* in Universität Köln Oberseminar Zahlentheorie und Modulformen, June 12, 2018.
- *Hilbert modular forms and Borcherds products* in Chalmers University of Technology, Algebraic Geometry and Number Theory Seminar, November 21, 2018.
- *Hilbert modular forms and Borcherds products* in Darmstadt Algebra Group Winter Seminar, February 22, 2019.
- *Hilbert modular forms and Borcherds products* in Dartmouth College Number Theory Seminar, May 23, 2019.
- *Higher pullbacks of modular forms on orthogonal groups* in Darmstadt Algebra Seminar, February 18, 2020.
- *Higher pullbacks of modular forms on orthogonal groups in Integrable systems and automorphic forms*, Sochi, Russia, February 23-27, 2020.
- *Free algebras of orthogonal modular forms* in Darmstadt Algebra Group Winter Seminar, March 13, 2020.
- *Simple lattices and free algebras of modular forms*, RWTH Aachen, January 18, 2021. (Online)
- *Simple lattices and free algebras of modular forms*, Brown University, March 1, 2021. (Online)
- *Borcherds products and a ring of Hermitian modular forms*, University of Oregon, May 3, 2021. (Online)
- *Weak Jacobi forms of rank two*, 34th Automorphic Forms Workshop, March 19, 2022. (Online)
- *Free algebras of modular forms on complex ball quotients* in Universität Bielefeld Oberseminar Gruppen und Geometrie, April 27, 2022.

- *Free algebras of modular forms on complex ball quotients* in International Seminar on Automorphic Forms, May 3, 2022. (Online)
- *Additive theta lifts that are Borcherds products* in ENTR Workshop, Darmstadt, Germany, October 27, 2022.
- *Modular products that are singular modulo primes*, KTH Royal Institute of Technology, Stockholm, June, 7, 2023.
- *Computation of vector-valued modular forms* (Lightning talk) in *LuCaNT*, ICERM, Providence, RI, July 13, 2023.

TEACHING
EXPERIENCE

RWTH Aachen, Germany

Teaching assistant

2020-present

- Complex analysis II
- Analytic number theory
- Smart Study Start - Mathematics (Introductory mathematics course)

Technische Universität Darmstadt, Germany

Teaching assistant

2019-2020

- Analysis II (English)
- Linear Algebra I (English)

University of California, Berkeley, CA

Instructor (GSI)

Summers 2014-2016

- Math 16B (Analytic geometry and calculus)
- Math 54 (Linear algebra and differential equations)
- Math 110 (Linear algebra)

Teaching assistant (GSI)

2013-2017

- Math 16A (Analytic geometry and calculus)
- Math 53 (Multivariable calculus)
- Math 54 (Linear algebra and differential equations)
- Math 55 (Discrete mathematics)
- Math H54 (Honors linear algebra and differential equations)
- Math 110 (Linear algebra)
- Math 185 (Introduction to complex analysis)
- Math 250A (Groups, rings, and fields)

Grader

Spring 2014

- Math H185 (Honors introduction to complex analysis)

Ruprecht-Karls-Universität Heidelberg, Germany

Teaching assistant (Tutor)

2011-2013

- Linear algebra
- Algebra 1 (field and Galois theory)
- Elementary number theory

MENTORING

Directed Reading Program

I met weekly with an undergraduate student at UC Berkeley and worked with them on an independent reading project that led to a presentation at the end of the semester.

- *Computing class numbers*, Fall 2016.
- *Elliptic curve cryptography*, Spring 2017.
- *Insolvability of the quintic equation*, Fall 2017.
- *Modular forms*, Spring 2018.

REVIEWING

- I have served as a referee for several journals including *Bull. Korean Math. Soc.*, *Compositio Math.*, *Forum Math.*, *J. Number Theory*, *Math. Annalen*, *Proc. A.M.S.*, *Proc. Natl. Acad. Sci. USA*, *Res. Number Theory*, *Transformation Groups*.
- I have reviewed papers for Mathematical Reviews (MathSciNet) and Zentralblatt MATH (zbMath).

OTHER EXPERIENCE

Ruprecht-Karls-Universität Heidelberg, Germany

- **Data mining practicum** (Summer 2012) Analyzed clusters in graphs of OSM geographic data using a variant of the PageRank algorithm.

Heidelberg Collaboratory for Image Processing, Heidelberg, Germany

- **Computer vision practicum** (Summer 2011) Used histograms of oriented gradients and related image descriptors to analyze illuminated manuscripts.

SOFTWARE

Programming languages:

- I am proficient with Python.
- I have some experience programming in C++ and Julia.

Mathematical software:

- Mathematica, MATLAB, SageMath

Other:

- \TeX (\LaTeX , \BibTeX),
- Microsoft Office, LibreOffice, Google Docs

LANGUAGES

English, German (fluent)

Dutch, French, Russian (intermediate)