## Brandon Williams


CONTACT INFORMATION

RWTH Aachen
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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**

- Thesis title: *Computing modular forms for the Weil representation*
- Adviser: Prof. Richard Borcherds
- Area of Study: Automorphic forms

**Ruprecht-Karls-Universität Heidelberg**, Germany

M.Sc., Mathematics **2011-2013**

- Thesis title: *On elliptic curves with complex multiplication, L-functions, and p-adic interpolation*
- Adviser: Prof. Dr. Otmar Venjakob

B.Sc., Mathematics **2009-2011**

- Thesis title: *GARCH(1,1)-models*
- Adviser: Prof. Dr. Rainer Dahlhaus

EMPLOYMENT

**RWTH Aachen**, Germany

Postdoctoral researcher **2020-present**

- Postdoc mentor: Prof. Dr. Aloys Krieg

**Technische Universität Darmstadt**, Germany

Postdoctoral researcher **2018-2020**

- Postdoc mentor: Prof. Dr. Jan Bruinier

AWARDS

- 2018 Ken Ribet – Lisa Goldberg Award in Algebra (department dissertation award)
- Lehmer Fellowship in Number Theory, Spring 2018.

PUBLICATIONS


[1] Williams, B. *Poincaré square series for the Weil representation*. Ramanujan J. 47 (2018), no. 3, 605–650.

[2] Williams, B. *Vector-valued Hirzebruch–Zagier series and class number sums*. Res. Math. Sci. 5 (2018), no. 2, Paper No. 25, 13 pp.

[3] Williams, B. *Rankin–Cohen brackets and Serre derivatives as Poincaré series*. Res. Number Theory 4 (2018), no. 4, Art. 37, 13 pp.

[4] Williams, B. *Vector-valued Eisenstein series of small weight*, 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 $M2$-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(sqrt29) and Q(sqrt37)*, 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*, arXiv:1910.11681, to appear in Forum Math.

## Submitted preprints

[15] Williams, B. *Two graded rings of Hermitian modular forms*, 2020, arXiv:2001.04154

[16] Wang, H. and Williams, B. *Borcherds products of half-integral weight*, 2020, arXiv:2007.00055

[17] Wang, H. and Williams, B. *Projective spaces as orthogonal modular varieties*, 2020, arXiv:2008.08392

[18] Wang, H. and Williams, B. *Simple lattices and free algebras of modular forms*, 2020, arXiv:2009.13343

## 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.

## TEACHING EXPERIENCE

**Technische Universität Darmstadt**, Germany

*Assistant* **2019-present**

- 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.

## 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:
- C++, Python

Mathematical software:
- Mathematica, MATLAB, SageMath

Other:
- TEX (LATEX, BIBTEX),
- Microsoft Office, LibreOffice, Google Docs

## Languages

English, German (fluent)
Dutch, French, Russian (intermediate)
Japanese (basic)