

CURRICULUM VITAE

MICHAEL H. MERTENS

PERSONAL DATA

Full Name	Michael Helmut Mertens
Date of Birth	July 16th, 1989
Place of Birth	Viersen, Germany
Citizenship	German

CONTACT DATA

Work address	Universität zu Köln Department Mathematik/Informatik Abteilung Mathematik Weyertal 86-90 50931 Köln Germany
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EDUCATION

March 2011	B. Sc. in Mathematics (minor Physics) at RWTH Aachen University, Germany, Thesis Title: “Primzahltests mit Elliptischen Kurven” (“Primality Tests using Elliptic Curves”) Advisor: Gabriele Nebe
September 2012	M. Sc. in Mathematics (minor Physics) at RWTH Aachen University, Germany, Thesis Title: “Duale Kegel und Automorphismengruppen Hyperbolischer Gitter” (“Dual Cones and Automorphism Groups of Hyperbolic Lattices”) Advisor: Gabriele Nebe
June 2014	Dr. rer. nat. <i>summa cum laude</i> (with distinction) in Pure Mathematics at Universität zu Köln, Germany, Thesis Title: “Mock Modular Forms and Class Numbers of Quadratic Forms”, Advisor: Kathrin Bringmann
January 2020	Habilitation in Mathematics at the Universität zu Köln, Germany, Thesis title: “Some applications of singular moduli and com- plex multiplication”, Advisor: Kathrin Bringmann

EMPLOYMENT

Oct. 2014 – Dec. 2014	Postdoc (wissenschaftlicher Mitarbeiter) at the Universität zu Köln.
Jan. 2015 – Aug. 2016	Postdoctoral Fellow at Emory University, Atlanta, GA.
Oct. 2016 – Mar. 2017	Postdoc (wissenschaftlicher Mitarbeiter) at the Max-Planck-Institut für Mathematik, Bonn
Apr. 2017 – Mar. 2019	Postdoc (wissenschaftlicher Mitarbeiter) at the Universität zu Köln
Apr. 2019 – Mar. 2020	Postdoc (wissenschaftlicher Mitarbeiter) at the Max-Planck-Institut für Mathematik, Bonn
Apr. 2020 – Aug. 2021	Lecturer at the University of Liverpool
Sep. 2021 – Sep. 2022	Postdoc (wissenschaftlicher Mitarbeiter) at the Universität Bielefeld (on leave since Oct. 2021)
since Oct. 2021	Akademischer Oberrat (equiv. to assistant professor, Mar. – Sep. 2022 substitute associate professor) at the Universität zu Köln

AWARDS AND FELLOWSHIPS

Oct. 2012 – Sep. 2014	Fellow of the DFG Graduiertenkolleg 1269 “Global Structures in Geometry and Analysis”
May 2014	offered Fulbright Scholarship (declined)
July 2014	Herrmann-Gedächtnispreis, awarded by the Mathematical Institute of the Universität zu Köln

RESEARCH INTERESTS

- Number Theory (Primary Classification 11)
- In particular
 - Modular Forms, Mock Modular Forms, and their generalizations
 - Moonshine
 - Quadratic Forms and Lattices
 - Primality Testing

PUBLICATIONS

Journal articles and preprints.

- (1) (with M. Kirschmer) *On an analogue of the Lucas-Lehmer-Riesel test using elliptic curves*, *Integers* **13** (2013), A15.
- (2) *Automorphism Groups of Hyperbolic Lattices*, *Journal of Algebra* **408** (2014), pp. 147–165.
- (3) *Mock Modular Forms and Class Number Relations*, *Research in the Mathematical Sciences* **1** (2014), no. 6.
- (4) *Eichler-Selberg Type Identities for Mixed Mock Modular Forms*, *Advances in Mathematics* **301** (2016), pp. 358–382.
- (5) (with Jehanne Dousse) *Asymptotic Formulas for Partition Ranks*, *Acta Arithmetica* **168** (2015), pp. 83–100.
- (6) (with Ken Ono) *Special values of shifted convolution Dirichlet series*, *Mathematika* **62** (2016), pp. 47–66.
- (7) (with Larry Rolen) *On class invariants for non-holomorphic modular functions and a question of Bruinier and Ono*, *Research in Number Theory* **1** (2015), no. 4.

- (8) (with Kathrin Bringmann and Ken Ono) *p-adic properties of modular shifted convolution L-functions*,
Proceedings of the American Mathematical Society **144** (2016), pp. 1439–1452.
- (9) (with Larry Rolen) *Lacunary recurrences for Eisenstein series*,
Research in Number Theory **1** (2015), no. 9.
- (10) (with Olivia Beckwith) *The number of parts in certain residue classes of integer partitions*,
Research in Number Theory **1** (2015), no. 11.
- (11) (with Olivia Beckwith) *On the number of parts of integer partitions lying in given residue classes*,
Annals of Combinatorics **21** (2017), pp. 507–517.
- (12) (with Michael J. Griffin) *A proof of the Thompson Moonshine Conjecture*,
Research in the Mathematical Sciences **3** (2016), no. 36.
- (13) (with John F. R. Duncan and Ken Ono) *O’Nan moonshine and arithmetic*,
American Journal of Mathematics **143** (2021), no. 4, S. 1115–1159.
- (14) (with John F. R. Duncan and Ken Ono) *Pariah moonshine*,
Nature Communications **8** (2017), Article 670.
- (15) (with Martin Raum) *Modular forms of virtually real-arithmetic type I – Mixed mock modular forms yield vector-valued modular forms*,
Mathematical Research Letters **28** (2021), pp. 511–561.
- (16) (with Pavel Guerzhoy and Larry Rolen) *Periodicities for Taylor coefficients of half-integral weight modular forms*,
Pacific Journal of Mathematics **307** (2020), pp. 137–157.
- (17) (with Lea Beneish) *On Weierstrass mock modular forms and a dimension formula for certain vertex operator algebras*,
Mathematische Zeitschrift **297** (2021), pp. 59–80.
- (18) (with Ken Ono and Larry Rolen) *Mock modular Eisenstein series with Nebentypus*,
International Journal of Number Theory **17** (2021), pp. 683–697.
- (19) (mit Letong Hong, Ken Ono und Shengtong Zhang) *Proof of the elliptic expansion Moonshine conjecture of Căldăraru, He, and Huang*,
Proceedings of the American Mathematical Society **150** (2022), S. 5047 – 5056.
- (20) (with Geoffrey Mason) *1-point functions for symmetrized Heisenberg and symmetrized lattice vertex operator algebras*,
Transactions of the American Mathematical Society **376** (2023), S. 3663 – 3693.
- (21) (with Miranda C. N. Cheng und John F. R. Duncan) *Class numbers, Cyclic Simple Groups and Arithmetic*,
to appear in *Journal of the London Mathematical Society*
- (22) (with Claudia Alfes-Neumann, Jens Funke und Eugenia Rosu) *On Jacobi-Weierstrass mock modular forms*,
submitted for publication.
- (23) (with K. Bringmann und B. Kane) *Hecke eigenforms for meromorphic cusp forms*,
submitted for publication.
- (24) (with Mark A. Norfleet) *Weight 1/2 multiplier systems for the groups $\Gamma_0(p)^+$ and a geometric formulation*,
submitted for publication.
- (25) (with Claudia Alfes-Neumann) *Abelian functions and Weierstrass mock modular forms*,
Preprint.

Books and book chapters.

- (1) *Elementare Zahlentheorie*, Logos Verlag Berlin, ISBN 978-3-8325-4886-5, 2019.
- (2) *The Ramanujan Handbook*, entries on *Rankin-Cohen brackets*, *Monstrous Moonshine*, *Umbral Moonshine*, and *Pariah Moonshine* (solicited by the editors), to appear.

TEACHING EXPERIENCE

2009 – 2012	Various positions as student assistant (Tutor), mainly at Lehrstuhl D für Mathematik, RWTH Aachen University
Summer 2014	Co-organizer (with Kathrin Bringmann, of student seminar “Asymptotische Entwicklungen von Modulformen”, Universität zu Köln
Winter 2014/15	Instructor for Preliminary course in Mathematics, Universität zu Köln Teaching assistant for lecture “Elliptic Functions and related topics” for Larry Rolen, Universität zu Köln
Spring 2015	Instructor for Math 212: Differential Equations, Emory University
Summer 2015	Instructor for 2015 REU at Emory University
Fall 2015	Instructor for Math 212: Differential Equations, Emory University Instructor for Math 221: Linear Algebra, Emory University
Spring 2016	Instructor for Math 212: Differential Equations, Emory University
Summer 2016	Instructor for 2016 REU at Emory University
Summer 2017	Instructor for Elementary Number Theory, Universität zu Köln
Winter 2018/19	Instructor for Analytic Number Theory, Universität zu Köln
Spring 2021	Instructor for MATH 449: Galois Theory, University of Liverpool
Summer 2021	Instructor for seminar on Quadratic Forms, Universität zu Köln
Winter 2021/22	Instructor for Differential Equations, Universität zu Köln
Summer 2022	Instructor for Complex Analysis, Universität zu Köln
Winter 2022/23	Instructor for Mathematics for prospective teachers I, Universität zu Köln
Summer 2023	Instructor for Mathematics for prospective teachers II, Universität zu Köln

ADVISED STUDENTS

Bachelor theses.

Winter 2017/18	Thomas Pellny, <i>Spezielle Werte der Riemann’schen ζ-Funktion</i> (Special values of the Riemann ζ -function)
	Tina Steinbach, <i>Transzendenz</i> (Transcendence)
Summer 2018	Lukas Gebert, <i>Primzahltests und Faktorisierungsmethoden</i> (Primality tests and factorization methods)
	Nina Samek, <i>Dedekind’sche Summen</i> (Dedekind sums)
Winter 2018/19	Lara Flato, <i>Elliptische Kurven in der Kryptographie</i> (Elliptic curves in cryptography, working title)
	Christopher Franz, <i>Darstellungen natürlicher Zahlen durch Summen von Potenzen</i> (Representations of natural numbers by sums of powers)
	Daniel Bach, <i>Elementare Beweise des Dirichlet’schen Primzahlsatzes</i> (Elementary proofs of Dirichlet’s theorem on primes in arithmetic progressions)

Master theses.

- Summer 2019 (with Kathrin Bringmann) Mohammed Soultana, *Fourier-Koeffizienten von Modulformen als Spuren von CM-Werten von schwachen harmonischen Maass-Formen und Partitionen* (Fourier coefficients of modular forms as traces of CM-values of harmonic weak Maass forms)
- Summer 2023 Hanyi Zhu, *Die Hauptmoduln in Monstrous Moonshine*

SELECTED TALKS

- 06 March, 2014 “Class Number Type Relations for Fourier Coefficients of Mock Modular Forms”, Automorphic forms, Lie algebra, and String theory, Université Lille 1.
- 11 January, 2015 “Holomorphic Projection and Mock Modular Forms”, Joint Mathematics Meeting, San Antonio, Texas.
- 05 March, 2015 “Special values of shifted convolution Dirichlet series”, 29th Automorphic Forms Workshop, University of Michigan, Ann Arbor, Michigan.
- 05 March, 2016 “Automorphism Groups of Hyperbolic Lattices”, AMS Spring Southeastern Sectional Meeting, University of Georgia, Athens, Georgia.
- 01 March, 2017 “Moonshine beyond the Monster”, Number Theory Seminar, University of Hong Kong.
- 06 September, 2017 “O’Nan Moonshine”, Conference on Number Theory, Geometry, Moonshine, and Strings, Simons Foundation, New York.
- 21 December, 2017 “Modular forms of virtually real-arithmetic type”, Trends in Modular Forms, National Institute for Mathematical Sciences (NIMS), Daejeon, Korea.
- 14 June, 2018 “Moonshine in weight $3/2$ ”, Vertex operator algebras, number theory, and related topics Conference in honor of Geoffrey Mason, Sacramento State University, Sacramento, California.
- July 2018 Lecture series on modular forms, Summer research institute on q -series Nankai University, Tianjin, China.
- 26 September 2019 “Periodicities of Taylor coefficients for half-integral weight modular forms”, DMV-Tagung, Section “Algebra and Number Theory”, KIT Karlsruhe.
- 03 February 2020 “Weierstrass mock modular forms and vertex operator algebras”, Algebra and Number Theory Seminar University of California, Santa Cruz, Kalifornien.
- 04 May 2021 “Finite groups, Modular Forms, and Arithmetic”, Theoretical Physics Colloquium University of Liverpool, UK.
- 25 March 2022 “Explicit formulas for 1-point functions in certain VOAs”, Number Theory Seminar ETH Zurich

28 October 2022

“Weierstrass and Kleinian mock modular forms and related constructions”,
 ENTR Workshop (Invited Speaker)
 TU Darmstadt

PROFESSIONAL ACTIVITIES

- Referee for the following journals
 - *Acta Arithmetica*
 - *Annals of Combinatorics*
 - *Archiv der Mathematik*
 - *Advances in Mathematics*
 - *Forum Mathematicum*
 - *International Journal of Mathematics and the Mathematical Sciences*
 - *International Journal of Number Theory*
 - *Journal of Number Theory*
 - *Mathematics*
 - *Proceedings of the American Mathematical Society*
 - *Research in the Mathematical Sciences*
 - *Research in Number Theory*
 - *The Ramanujan Journal*
 - *SIGMA*
- Co-organizer (with Kathrin Bringmann, Igor Burban, Peter Littelmann, Larry Rolen, and Bea Schumann) of the Spring School “Characters of Representations and Modular Forms”, Max-Planck-Institut für Mathematik, Bonn, Germany, March 23–27, 2015.
- Co-organizer (with John Duncan) of the Algebra and Number Theory Seminar, Emory University, Fall 2015.
- Co-organizer (with Kathrin Bringmann) of the Oberseminar Zahlentheorie, Universität zu Köln, April 2017–March 2019.

LANGUAGES

- German (native)
- English (fluent in written and spoken)
- French (fluent in written, good in spoken)
- Dutch (advanced beginner)
- Spanish (basic knowledge)