

Martin Raum

Date of Birth	April 9, 1985
Nationality	German
E-mail address	martin@raum-brothers.eu
Website	martin.raum-brothers.eu
ORCID	0000-0002-3485-8596

Current and Previous Academic Positions

Since Apr. '21	Professor at Chalmers University of Technology, Gothenburg, Sweden.
Nov. '22 to Jan. '23	Visiting Professor at Pontificia Universidad Católica de Valparaíso, Chile.
Oct. '16 to Mar. '21	Associate Professor at Chalmers University of Technology, Gothenburg, Sweden.
Jun. '15 to Sep. '16	Senior Lecturer at Chalmers University of Technology, Gothenburg, Sweden.
Sep. '14 to May '15	Post-doc at MPI for Mathematics, Bonn, Germany.
Sep. '12 to Aug. '14	ETH Fellow at ETH Zurich, Switzerland.
Jun. to Aug. '12	Post-doc at MPI for Mathematics, Bonn, Germany.

Education

Oct. '16	Docentship at Chalmers University of Technology, Gothenburg, Sweden.
Jun. '12	PhD in Mathematics at University of Bonn, Germany. Adviser: Don Zagier. Magna cum laude.
Mar. '09	Diplom Mathematik at RWTH University Aachen, Germany.

Awards

Jun. '22	Wallenberg Prize by the Swedish Mathematical Society.
Nov. '11	Friedrich-Wilhelm-Preis by RWTH Aachen University.
Jun. '10	Springorum-Denk Münze by RWTH Aachen University.
Oct. '09	Highest award at the DMV Studierendenkonferenz.
Jun. '08	Schöneborn-Preis by RWTH Aachen University.
Sep. '04	Highest award in the German federal competition in computer sciences.
Sep. '04	Special award for Human-Computer-Interface-Design.

Scholarships

Oct. '09 to Jun. '12	IMPRS scholarship by the Max Planck Society.
Nov. '04 to Mar. '09	Scholarship by the Studienstiftung des deutschen Volkes.

Grants (approx. 1,385,000€ total)

Apr. '21	<i>Post-doc Project Grant. KAW.</i> 2,150,000SEK (approx. 200,000€). Degenerations of motivic periods and string loop amplitudes.
Apr. '20	<i>Conference Grant. Crafoord Foundation.</i> 210,000SEK (approx. 20,178€). The Langlands Program and Arithmetic Geometry. Co-PIs: Wushi Goldring, Christian Johansson, Dan Petersen.
Oct. '19	<i>Project Grant. Swedish Research Council.</i> 3,200,000SEK (approx. 300,000€). Real-Analytic Orthogonal Modular Forms as Generating Series.
Apr. '18	<i>Post-doc Project Grant. KAW.</i> 2,142,000SEK (approx. 200,000€). The skew Maaß lift: Aftermath in representation theory and physics.
Sep. '16	<i>Workshop Grant. GoCAS.</i> 30,000SEK (approx. 3,100€). Number Theory Visitor Seminar Fall '16. Co-Is: Julia Brandes, Dennis Eriksson, Sebastián Herrero.
Sep. '16	<i>Visiting Scientist Grant. GoCAS.</i> 31,000SEK (approx. 3,200€). Research visit of Yingkun Li.

- Jun. '16 *Interdisciplinary Seed Grant. GoCAS.* 292,000SEK (approx. 32,000€). FPGA design methods, with application to pure mathematics. Co-PIs: Mary Sheeran, Carl-Johan Seger, Bo Joel Svensson.
- Jan. '16 *Conference Grant. GoCAS.* 45,000SEK (approx. 4,900€). Conference on Interactions between Ergodic Theory and Number Theory. Co-PIs: Dennis Eriksson, Michael Björklund.
- Jan. '16 *Conference Grant. GoCAS.* 25,000SEK (approx. 2,700€). Fifth Workshop of the Nordic Number theory Network. Co-PIs: Julia Brandes, Dennis Eriksson, Per Salberger, Amos Turchet.
- Nov. '15 *Unga Forskare Project Grant. Swedish Research Council.* 3,000,000SEK (approx. 330,000€). Siegel Modular Generating Functions.
- Jul. '15 *Conference Grant. GoCAS.* 35,000SEK (approx. 3,800€). Third Workshop of the Nordic Number theory Network. Co-PIs: Dennis Eriksson, Per Salberger, Amos Turchet.
- Jun. '12 *ETH Fellowship.* CHF200,000 (approx. 242,000€). Real-analytic Siegel modular forms.
- Jan. '12 *RWTH Aachen Internal Grant.* 6,000€. 1st EU-US conference on Automorphic Forms and related topics. Co-PI: Aloys Krieg.
- Dec. '11 *NSF-Grant DMS-1153219.* \$50,000 (approx. 36,000€). 1st EU-US conference on Automorphic Forms and related topics. Co-PIs: Olav Richter, Lynne Walling.

PhD Students and Post-docs

- Since Jun. '22 *Jan Feldmann.* PhD student. Chalmers University of Technology. Principal adviser. Co-adviser is Anders Södergren.
- Since Sep. '22 *Adam Keilthy.* Post-doc. Chalmers University of Technology.
- Graduated May. '23 *Tobias Magnusson.* PhD student. Chalmers University of Technology. Principal adviser. Co-adviser was Anders Södergren.
- Graduated May. '21 *Jiacheng Xia.* PhD student. Chalmers University of Technology. Principal adviser. Co-adviser was Dennis Eriksson.
- Mar. '19 to Feb. '21 *Caihua Luo.* Post-doc. Chalmers University of Technology.
- Graduated Jan. '20 *Manh Hung Tran.* PhD student. Chalmers University of Technology. Co-adviser. Principal adviser was Dennis Eriksson. Previous adviser was Per Sahlberger.
- Dec. '16 to Dec. '18 *Sebastián Herrero.* Post-doc. Chalmers University of Technology. Now professor at Pontificia Universidad Católica de Valparaíso.
- Graduated Oct. '17 *Andreas Freh.* PhD student. RWTH Aachen University. Co-advised with Aloys Krieg.

Service

- Since '10 Referee/Reviewer for MathSciNet, zbMath, AJM, Compositio, Advances, IMRN, J. LMS etc. Approx. 25 reviews per year.
- Since '15 Occasional reviewer for science grants from e.g. NSF. Three in total.
- Since May '23 Advisory committee on OpenScience, Chalmers University of Technology.
- May '19 to Nov. '22 Department council of the Department of Mathematical Sciences.
- Jun. '19 PhD committee for Medet Nursultanov, Chalmers University of Technology.
- Jul. '18 Program committee, NPFL 2018 at ICFP (Computer Science).
- Sep. '17 Interdisciplinary panel, KAW grants, Chalmers University of Technology.
- Sep. '16 to Dec. '17 Organizer of the Chalmers Number Theory and Geometry Seminar.
- Sep. '13 to Aug. '14 Co-Organizer, Number Theory Seminar, ETH Zurich.

Institutional Memberships

- European Mathematical Society.
German Mathematical Society.

Organized Events

- Jun. '22 *Topology and Arithmetic around the Langlands Program.* Stockholm University. Organized jointly with Wushi Goldring, Christian Johansson, Dan Petersen.
- Sep. '17 *Real-Analytic Automorphic Forms.* University of North Texas. Organized jointly with Olav Richter.
- May '17 *Modular forms are everywhere. Birthday conference for Don Zagier.* MPI for Mathematics. Organized jointly with Kathrin Bringmann, Michael Griffin, Maxim Kontsevich, Pieter Moree, Ken Ono.
- Nov. '16 *Fifth workshop of the Nordic Number theory Network.* Chalmers University of Technology. Organized jointly with Julia Brandes, Dennis Eriksson, Per Salberger, and Amos Turchet.
- Aug. '16 *Workshop in Number Theory and Dynamics.* Chalmers University of Technology. Organized jointly with Michael Björklund and Dennis Eriksson.
- Dec. '15 *Third workshop of the Nordic Number theory Network.* Chalmers University of Technology. Organized jointly with Dennis Eriksson, Per Salberger, and Amos Turchet.
- Aug. '12 *1st EU-US conference on Automorphic Forms and related topics.* RWTH Aachen University. Organized jointly with Aloys Krieg, Olav Richter, and Lynne Walling.
- Mar. '10 *AKLS Student Section.* RWTH Aachen University.
- Spring '09 *Research Seminar on Borcherds Products.* RWTH Aachen University.

Selected Taught Courses

- 2022 *High Performance Computing.*
Chalmers University of Technology, Gothenburg, Sweden.
Fall '22. Approx. 180 students.
-
- Algebraic Number Theory.*
Chalmers University of Technology, Gothenburg, Sweden.
Winter '20. Approx. 10 students.
-
- 2018 *High Performance Computing.*
Chalmers University of Technology, Gothenburg, Sweden.
Fall '18. Approx. 150 students.
-
- 2017 *High Performance Computing.*
Chalmers University of Technology, Gothenburg, Sweden.
Spring '17. Approx. 50 students.
-
- 2016 *Number Theory.*
Chalmers University of Technology, Gothenburg, Sweden.
Fall '16. Approx. 10 students.
-
- High Performance Computing.*
Chalmers University of Technology, Gothenburg, Sweden.
Spring '16. Approx. 15 students.
-
- Elliptic Modular Forms and Generating Series.*
Chalmers University of Technology, Gothenburg, Sweden.
Winter '16. Approx. 10 students.

Research Publications (33 peer-reviewed published articles, 3 accepted articles, 5 preprints)

- 2023 *A classification of harmonic weak Maass forms of half-integral weight.*
 Joint with Claudia Alfes-Neumann.
 Res. Number Theory 9.48 (2023), 15 pp. arXiv 2202.00744 (2022).
-
- Relations among Ramanujan-Type Congruences II.*
 Forum Math. 35.3 (2023), pp. 615–646. arXiv 2105.13170 (2021).
-
- 2022 *Relations among Ramanujan-Type Congruences I.*
 Advances in Math. 409 (2022), 47 pp. arXiv 2010.06272 (2020).
-
- Congruences of Hurwitz class numbers on square classes.*
 Joint with Olivia Beckwith and Olav Richter.
 Advances in Math. 409 (2022), 19 pp. arXiv 2203.11273 (2022).
-
- 2021 *The maximal discrete extension of the Hermitian modular group.*
 Joint with Aloys Krieg and Annalena Wernz.
 Doc. Math. 26 (2021), pp. 1871–1888. arXiv 1910.12466 (2019).
-
- Modular forms of virtually real-arithmetic type I.*
 Joint with Michael H. Mertens.
 Math. Res. Lett. 28.2 (2021), pp. 511–561. arXiv 1712.03004 (2017).
-
- 2020 *Non-Holomorphic Ramanujan-type Congruences for Hurwitz Class Numbers.*
 Joint with Olivia Beckwith and Olav Richter.
 Proc. Nat. Acad. Sci. U.S.A. 117.36 (2020), pp. 21953–21961. arXiv 2004.06886 (2020).
-
- All modular forms of weight 2 can be expressed by Eisenstein series.*
 Joint with Jiacheng Xia.
 Res. Number Theory 6.32 (2020), 16 pp. arXiv 1907.03616 (2019).
-
- 2019 *The skew-Maass lift I.*
 Joint with Olav Richter.
 Res. Math. Sci. 6.2 (2019), 59 pp. arXiv 1810.06810 (2018).
-
- 2018 *Hyper-Algebras of Vector-Values Modular Forms.*
 SIGMA 14.108 (2018), 17 pp. HAL-01289143 (2016).
-
- 2017 *Indecomposable Harish-Chandra modules for Jacobi groups.*
 Contributions in Mathematical and Computational Sciences 10 (2017), pp. 231–249.
 L-Functions and Automorphic Forms, Heidelberg.
-
- Products of Vector Valued Eisenstein Series.*
 Forum Math. 29.1 (2017), pp. 157–186. arXiv 1411.3877 (2014).
-
- 2016 *On Direct Integration for Mirror Curves of Genus Two and an Almost Meromorphic Siegel Modular Form.*
 Joint with Albrecht Klemm, Maximilian Poretschkin, and Thorsten Schimannek.
 Commun. Number Theory Phys. 10.4 (2016), pp. 587–701. arXiv 1502.00557 (2015).
-
- Almost holomorphic Poincaré series corresponding to products of harmonic Siegel-Maass forms.*
 Joint with Kathrin Bringmann and Olav Richter.
 Res. Math. Sci. 3.30 (2016), 16 pp. arXiv 1604.05105 (2016).
-

- Harmonic Weak Siegel Maaß Forms I.*
Int. Math. Res. Not. (2016), pp. 1442–1472. arXiv 1510.03342 (2015).
-
- Harmonic Maaß-Jacobi forms of degree 1 with higher rank indices.*
Joint with Charles Conley.
Int. J. Number Theory 12.07 (2016), pp. 1871–1897. arXiv 1012.2897 (2010).
-
- Computing Genus 1 Jacobi Forms.*
Math. Comp. 85 (2016), pp. 931–960. arXiv 1212.1834 (2012).
-
- Spans of special cycles of codimension less than 5.*
J. Reine Angew. Math. 718 (2016), pp. 39–57. arXiv 1302.1451 (2013).
-
- 2015 *Sturm Bounds for Siegel Modular Forms.*
Joint with Olav Richter.
Res. Number Theory 1.5 (2015), 8 pp. arXiv 1501.07733 (2015).
-
- Kudla's Modularity Conjecture and Formal Fourier-Jacobi Series.*
Joint with Jan Hendrik Bruinier.
Forum Math. Pi 3 (2015), 30 pp. arXiv 1409.4996 (2014).
-
- Formal Fourier Jacobi Expansions and Special Cycles of Codimension Two.*
Compos. Math. 151.12 (2015), pp. 2187–2211. arXiv 1302.0880 (2013).
-
- The Structure of Siegel Modular Forms modulo p and $U(p)$ Congruences.*
Joint with Olav Richter.
Math. Res. Lett. 22.3 (2015), pp. 899–928. arXiv 1312.559 (2013).
-
- Harmonic Maass-Jacobi forms with singularities and a theta-like decomposition.*
Joint with Kathrin Bringmann and Olav Richter.
Trans. Amer. Math. Soc. 367.9 (2015), pp. 6647–6670. arXiv 1207.5600 (2012).
-
- H-Harmonic Maaß-Jacobi Forms of Degree 1.*
Res. Math. Sci. 2.12 (2015), 34 pp. arXiv 1207.5603 (2012).
-
- 2014 *Holomorphic projections and Ramanujan's mock theta functions.*
Joint with Özlem İmamoğlu and Olav Richter.
Proc. Nat. Acad. Sci. U.S.A. 111.11 (2014), pp. 3961–3967. arXiv 1306.3919 (2013).
-
- 2013 *M_{24} -twisted Product Expansions are Siegel Modular Forms.*
Commun. Number Theory Phys. 7.3 (2013), pp. 469–495. arXiv 1208.3453 (2012).
-
- Mock period functions, sesquiharmonic Maass forms, and non-critical values of L -functions.*
Joint with Kathrin Bringmann and Nikolaus Diamantis.
Advances in Math. 233 (2013), pp. 115–134. arXiv 1107.0573 (2011).
-
- Computing Borcherds Products.*
Joint with Dominic Gehre and Judith Kreuzer.
LMS J. Comput. Math. 16 (2013), pp. 200–215. arXiv 1111.5574 (2011).
-
- The functional equation of the twisted spinor L -function in genus 2.*
Joint with Aloys Krieg.
Abh. Math. Semin. Univ. Hambg. 83.1 (2013), pp. 29–52. arXiv 0907.2767 (2009).
-
- 2012 *Kohnen's limit process for real-analytic Siegel modular forms.*
Joint with Kathrin Bringmann and Olav Richter.
Advances in Math. 231 (2012), pp. 1100–1118. arXiv 1105.5482 (2011).

-
- 2011 *How to implement a modular form.*
J. Symb. Comp. 46.12 (2011), pp. 1336–1354. MPI Preprint 582312 (2010).
-
- Hecke algebras related to the unimodular and modular groups over quadratic field extensions and quaternion algebras.*
Proc. Amer. Math. Soc. 139.4 (2011), pp. 1321–1331. arXiv 0907.2766 (2009).
-
- 2010 *Efficiently generated spaces of classical Siegel modular forms and the Boecherer conjecture.*
J. Aust. Math. Soc. 89.3 (2010), pp. 393–405. arXiv 1002.3883 (2010).

Accepted

Scalar-valued depth two Eichler-Shimura Integrals of Cusp Forms.
Joint with Tobias Magnusson.
Accepted for publication in Trans. LMS. arXiv 2209.00488 (2022).

On the Computation of General Vector-valued Modular Forms.
Joint with Tobias Magnusson.
Accepted for publication in Math. Comp. arXiv 2202.06676 (2022).

Scarcity of congruences for the partition function.
Joint with Scott Ahlgren and Olivia Beckwith.
Accepted for publication in Am. J. Math. arXiv 2006.07645 (2020).

Preprints

Imaginary quadratic fields with ℓ -torsion-free class groups.
Joint with Olivia Beckwith, Olav Richter.
arXiv 2305.19272 (2023).

A classification of polyharmonic Maaß forms via quiver representations.
Joint with Claudia Alfes-Neumann and Igor Burban.
arXiv 2207.02278 (2022).

The Bernstein–Gelfand Tensor Product Functor and the Weight-2 Eisenstein Series.
arXiv 2205.08226 (2022).

Eichler integrals and generalized second order Eisenstein series.
Joint with Albin Ahlbäck and Tobias Magnusson.
arXiv 2203.15462 (2022).

Hyperelliptic Curves over Small Finite Fields and GPU Accelerators.
arXiv 1805.11991 (2018).

Books

Modular Forms are Everywhere: Celebration of Don Zagier’s 65th Birthday.
Co-Edited with Ken Ono, Kathrin Bringmann, Maxim Kontsevich, Pieter Moree.
Research in the Mathematical Sciences, Topical Collection.

Siegel Modular Forms and Jacobi Forms.
In preparation. Publishing agreement with Springer.

Various Publications

K. Bringmann, A. Folsom, K. Ono, L. Rolin: "Harmonic Maass Forms and Mock Modular Forms: Theory and Applications".

Jahresber. Dtsch. Math. Ver. 121.4 (2019), 291–296.

From Solutions of polynomial equations to the Langlands Program.

Svenska Matematikersamfundet Bulletin Okt. 2018.

Harmonic weak Siegel Maass forms.

Oberwolfach Reports 2016.23.

Analytic properties of some indefinite theta series.

Oberwolfach Reports 2016.3.

Appendix to Pinched hypersurfaces contract to round points by M. Franzen.

arXiv 1502.07908 (2015).

Symmetric Formal Fourier Jacobi Series and Kudla's Conjecture.

Oberwolfach Reports 2014.2.

Dual weights in the theory of harmonic Siegel modular forms.

Ph.D. Thesis, University of Bonn (2012).

Konstanten der Arithmetik: Perioden und ihre Relationen.

Joint with Sven Raum.

Annual report of the Max Planck Society, MPI for Mathematics (2012).

The functional equation for certain twisted Rankin convolutions and an application to the spinor L-function.

Diplomarbeit (former days' master thesis), RWTH Aachen University (2009).

Software

ModularForms.jl.

Joint with Albin Ahlbäck and Tobias Magnusson.

GitLab, <https://gitlab.com/mraum/modularforms.jl> (2022).

Contributions to the computer algebra system Oscar (since 2018).

AbstractAlgebra.jl, Nemo.jl, and Hecke.jl GitHub Repositories.

QuickTest.jl.

GitHub, <https://github.com/martinra/QuickTest.jl> (2016).

HyCu.

GitHub, <https://github.com/martinra/hycu> (2016).

Contributions to Sage (2011–2015).

Sage Trac Server #19668, #14482, #13531, #11624, #11139, #10987, #10837, #8094, #7474, #6671, #6670, #6669, #5731, #4578.

HLinear.

GitHub, <https://github.com/martinra/hlinear> (2015).

HFlint.

GitHub, <https://github.com/martinra/hflint> (2015).

algebraic-structures.

GitHub, <https://github.com/martinra/algebraic-structures> (2015).

Genus 1 Jacobi Forms.

Sage Trac Server #16448 (2014).

Jacobi Forms.

Sage Extension in Purple Sage (2012).

Modular Forms Framework.

Sage Extension in Purple Sage (2011).

Computation of Siegel Modular Forms of Genus 2.

Joint with Alex Ghitza, Nathan Ryan, Nils-Peter Skoruppa, and Gonzalo Tornaría.

Sage Extension in Purple Sage (2011).