Marius Leonhardt

Curriculum Vitae

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Research Interests

Area Arithmetic Geometry

Topics Rational points, Anabelian geometry, Abelian varieties, complex multiplication, Shimura varieties

Employment

since Apr 2020 **Research Associate**, Universität Heidelberg.
Arbeitsgruppe of Prof. Alexander Schmidt (Arithmetic Homotopy Theory).
Since Sept 2021: part of **CRC-TRR GAUS** (https://crc326gaus.de/), project C01.
Since June 2022: additional role as **person of contact for young researchers** within GAUS; **mentor** of two PhD students.

Publications and Preprints

4. **Linear and quadratic Chabauty for affine hyperbolic curves** (with M. Lüdtke and J.S. Müller), Int. Math. Res. Not. IMRN, 2023; https://doi.org/10.1093/imrn/rnad185, arXiv:2301.11193
3. **Bounds on the Chabauty–Kim locus of hyperbolic curves** (with L.A. Betts and D. Corwin), accepted at IMRN; arXiv:2206.11085
2. **Plectic Galois actions on CM points and connected components of Hilbert modular varieties**, Bull. Lond. Math. Soc., 54(6):2254–2277, 2022; https://doi.org/10.1112/blms.12692, arXiv:2001.11097
1. **Plectic Arithmetic of Hilbert modular varieties**, PhD thesis, https://doi.org/10.17863/CAM.49057

Education

2015 – 2020 **Ph.D. in Pure Mathematics**, University of Cambridge, DPMMS.
Thesis: **Plectic Arithmetic of Hilbert modular varieties**.
Supervisor: Tony Scholl

2012 – 2015 **M.Sc. in Mathematics**, Universität Heidelberg and Karlsruhe Institute of Technology.
Started at Karlsruhe, interrupted for a year at Cambridge, continued at Heidelberg.
Master thesis: **Galois characteristics of local fields**.
Thesis advisor: Alexander Schmidt. Final grade: 1.0.

2013 – 2014 **MAST in Mathematics**, University of Cambridge, Trinity College.
Part III essay (mini thesis): p-**adic** L-**functions**.
Essay advisor: Tony Scholl. Final grade: with distinction.

2009 – 2012 **B.Sc. in Mathematics**, Karlsruhe Institute of Technology.
Bachelor thesis: **Minkowski's existence and uniqueness theorem for surface area measures**.
Thesis advisor: Daniel Hug.

Scholarships and Awards

2017 **Smith-Knight & Rayleigh-Knight Prize**, essay prize.
2015 **EPSRC Studentship #1648608**, covering university fees.
2015 **Trinity Internal Graduate Studentship**, maintenance stipend.
2011 – 2015 **German National Academic Foundation**, monthly stipend .
2011 – 2012 **Deutschlandstipendium**, monthly stipend.

Talks

At conferences and workshops.

- Journées Arithmétiques, Nancy, July 2023.
- British Mathematical Colloquium (BMC-BAMC), Glasgow, April 2021.
- Christmas workhop for geometry and number theory, Karlsruhe, Dec 2019.
- Young Researchers in Algebraic Number Theory, Warwick, Nov 2019.
- Journées Arithmeétiques, Istanbul, July 2019.
- Young Researchers in Algebraic Number Theory, Sheffield, Nov 2018.
- "Kleine AG" about Shimura varieties, Bonn, Oct 2018.

At research seminars.

- Algebra seminar, Groningen, May 2022.
- DFG research group "symmetry, geometry, arithmetic", Heidelberg, Jan 2020.
- Linfoot Number Theory Seminar, Bristol, May 2018.
- Junior Seminar, Lancaster, April 2018.
- Number Theory Seminar, Cambridge, Feb 2017.
- Number Theory Seminar, Copenhagen, Dec 2016.
- Junior Algebra/Logic/Number Theory Seminar, Cambridge, Nov 2016.

General mathematical audience and colloquia.

- Trinity Mathematical Society Centenary Symposium, Cambridge, Feb 2019.
- Trinity Mathematical Society Symposium, Cambridge, Feb 2018.
- PhD Colloquium, Cambridge, April 2017.

University teaching

since 2020 **Universität Heidelberg**.

- Summer Term 2024: Algebraic Number Theory II (exercise sheets)
- Winter Term 2023/24: Étale cohomology I (example classes)
- Summer Term 2023: Galois cohomology II (example classes)
- Winter Term 2022/23: Galois cohomology I (example classes)
- Winter Term 2022/23: Visualising root systems (HEGL student project with A. Strupp), `https://apps.hegl.mathi.uni-heidelberg.de/Proseminar-WS22-Root-Systems/`
- Summer Term 2022: Galois and fundamental groups (seminar)
- Summer Term 2021: Arithmetic of Elliptic Curves (lecture)
- Winter Term 2020/21: Algebra 1 (teaching assistant, example classes and sheets)
- Winter Term 2020/21: p-adic numbers (proseminar)
- Summer Term 2020: Lubin–Tate theory (seminar)
- Summer Term 2020: E-Learning challenge about digital realisation of seminars
- Supervision of Bachelor theses:
  - I. Gernand: Inverse Galois Theory for the groups D_4 and C_5.
  - T. Karl: Wieferich's Theorem.
  - I. Klevesath: Tilts of perfectoid fields.
  - D. Kliemann: Infinitely many irregular primes under congruence conditions.
  - P. Mack: Quadratic forms over $\mathbb{Q}$.
  - C. Merten: Resolution of unbounded complexes.
  - J. Niederer: Inverse Galois Theory for the groups C_4 and D_5.
  - C. Sautter: Solubility of the cubic Fermat equation in quadratic number fields.
  - K. Seefeldt: Henselian fields and Newton polygons.
  - J. Wolff: Hilbert's Irreducibility Theorem.
- Supervision of Master thesis:
  - R. Paus: Relations in ramification groups.

2015 – 2019 **University of Cambridge**, supervisor and teaching assistant.

- Easter Term 2019: number fields.
- Lent Term 2019: algebraic geometry.
- Michaelmas Term 2018: Lie algebras and their representations (teaching assistant).
- Easter Term 2018: number fields.

- Lent Term 2018: groups — rings — modules.
- Michaelmas Term 2017: Lie algebras and their representations (teaching assistant).
- Easter Term 2017: number fields.
- Lent Term 2016: number fields.
- Michaelmas Term 2016: number theory.
- Easter Term 2016: number fields.
- Lent Term 2016: number fields.
- Michaelmas Term 2015: linear algebra.

2014 – 2015 **Universität Heidelberg**, examples classes.
- Summer Term 2015: functional analysis.
- Winter Term 2014/15: advanced mathematics III for physicists.

2010 – 2013 **Universität Karlsruhe**, examples classes.
- Summer Term 2013: coding and cryptography (seminar).
- Winter Term 2012/13: mathematics III for economical engineers.
- Winter Term 2012/13: stochastic geometry (lecture notes).
- Summer Term 2012: probability theory.
- Summer Term 2012: spatial stochastics (lecture notes).
- Winter Term 2011/12: introduction to stochastics.
- Summer Term 2011: mathematics II for economical engineers.
- Winter Term 2010/11: mathematics I for economical engineers.

Other Teaching Activities

July 2024 **Course Instructor**, Deutsche Schülerakademie Torgelow.
Organising a course about the magic of solving or insolubility of (algebraic, Diophantine, differential) equations, aimed at final year high school students (age 17).

Aug 2021 **Course Instructor**, Deutsche Schülerakademie (online).
Organising a course about elliptic curve cryptography, aimed at final year high school students (age 17).

Feb 2020 **Course Instructor**, Abiturma, Germany.
Teaching a preparatory course for the final mathematics exam (Abitur) in high school.

July 2018 **Course Instructor**, Deutsche JuniorAkademie Neuerburg.
Organising and realising a course about the mathematical and practical aspects of knots, aimed at secondary school students (age 13).

Organisational Roles

Oct 2023 organiser of a retreat for the junior researchers within GAUS, Oberwesel.

Apr 2023 Study group on six functor formalism and Poincaré duality, Heidelberg.

2023 organiser of "What is . . . ?" seminar for young researchers, Heidelberg.

May 2019 organiser of a workshop ("Kleine AG") on Serre's Modularity Conjecture, Bonn.

2015 – 2019 chair of the number theory section of the part III seminars, Cambridge.

Oct – Dec 2017 Learning Seminar on Drinfeld upper half plane and p-adic uniformization of Shimura curves, Cambridge.

May – July 2017 Learning Seminar on p-adic Hodge theory, perfectoid spaces and Scholze's torsion paper, Cambridge.

Participation at selected conferences and workshops

May/June 2023 An expedition into Arithmetic Geometry, Leiden.

Oct 2022 Arithmetic Algebraic Geometry, Darmstadt.

Sept 2022 Women in Arithmetic Geometry, Heidelberg.

Aug 2022 Mordell Conference (100 years of elliptic curves), Cambridge.

Apr 2022 Cohomology of varieties, Warsaw.

July 2020 Lean for the Curious Mathematician, Online.

Nov 2019 Workshop ("Kleine AG") on Lawrence–Venkatesh's proof of Mordell's conjecture.

June 2019 Summer School on Computational Number Theory, Bristol.

Oct 2017	Workshop ("Kleine AG") on Faltings' *Endlichkeitssätze für Abelsche Varietäten*, Heidelberg.
Mar 2017	Arizona Winter School on Perfectoid Spaces, Tucson.
Feb 2017	Workshop ("Kleine AG") on Tate's p*-divisible groups*, Heidelberg.
June 2016	"Crash course" on Shimura varieties, Leiden.

Study groups

2023/24	Applications of the étale fundamental gerbe, Heidelberg and Frankfurt.
2023	Six functor formalism and Poincaré duality, Heidelberg.
2022/23	K-theory of the integers, Heidelberg and Mainz.
2022	Tamagawa's Grothendieck conjecture for affine curves, Heidelberg and Frankfurt.
2021/22	Hübner–Schmidt's Tame cohomology, Heidelberg.
2021/22	Fornea–Gehrmann's Plectic Stark–Heegner points, Heidelberg.
2021	Boxer–Pilloni's Higher Hida Theory, Heidelberg.
2020/21	Clausen–Scholze's Condensed Mathematics, Heidelberg.
2020	Lawrence–Venkatesh's Diophantine problems and p-adic period mappings, Heidelberg.
2019	Deligne–Lusztig theory, Cambridge.
2018	Lawrence–Venkatesh's proof of the Mordell conjecture, Cambridge.
2018	Geometric Satake equivalence, Cambridge.
2018	Vincent Lafforgue's shtukas and excursion operators, Cambridge.
2017	Scholze–Weinstein's moduli of p-divisible groups, Cambridge.
2017	Drinfeld's work, Cambridge.
2016	The Euler system of Heegner points, Cambridge.
2016	Jacquet–Langlands, Cambridge.
2016	Scholze's Langlands–Kottwitz method for the modular curve, Cambridge.

Languages and IT

Languages	German (native), English (fluent), Spanish (basic), French (reading)
IT	Basic knowledge of SageMath, some knowledge of Python

Hobbies

climbing, mountaineering, roundnet, reading