Curriculum Vitae
David Helm

Office Address: Department of Mathematics
South Kensington Campus
Imperial College London
London SW7 2AZ
dhelm@ imperial.ac.uk
http://www2.imperial.ac.uk/~dhelm

Education/Employment:

2016 –	Reader, Imperial College
2013 – 2016	Senior Lecturer, Imperial College
2013	Visitor, Université Pierre et Marie Curie (Paris 6)
2007 – 2013	Assistant Professor, University of Texas
2003 – 2007	Benjamin Pierce Assistant Professor, Harvard University
2003 Ph.D.	University of California, Berkeley, Mathematics (advisor: Ken Ribet)
1999 A.B.	Harvard University, Cambridge, MA, Mathematics. (Magna cum laude, with highest honors in field.)

Scientific/Academic Honors and Grants:

2020 –	EPSRC New Horizons grant (successful, funding pending)
2015 – 2018	EPSRC Standard Grant EP/M029719/1 (£315,611)
2012 – 2015	National Science Foundation Grant DMS-1161582 ($135,999, 6/01/2012 – 5/31/2015)
2003 – 2005	National Science Foundation Postdoctoral Research Fellowship
1999 – 2002	National Science Foundation Graduate Research Fellowship
2001	Charles B. Morrey, Jr. Award (Berkeley Math Department)

Research Interests:

Number theory, particularly the geometry of Shimura varieties, the representation theory of p-adic algebraic groups and their application to the Langlands correspondence.

Publications and Preprints:

1. (with Jean-Francois Dat, Robert Kurinczuk, and Gilbert Moss) *Moduli of Langlands parameters*, arxiv:2009:06708, submitted.
2. (with Harrison Chen, David Nadler and David Ben-Zvi) *Coherent Springer theory and the categorical Deligne-Langlands correspondence*, arxiv:2010.02321, submitted.
3. *An ordinary abelian variety with an étale self-isogeny of p-power degree and no isotrivial factors*, arxiv:2009:08236, to appear in Math. Res. Lett.
4. (with Jean-Francois Dat, Robert Kurinczuk, and Gilbert Moss) *The local Langlands correspondence in families for classical groups at banal primes*, in preparation.
5. (with Johannes Girsch) *On families of degenerate representations of $GL_n(F)$*, in preparation.
6. (with Patrick Allen, Frank Calegari, Ana Caraiani, Toby Gee, Bao Le Hung, James Newton, Peter Scholze, Richard Taylor, and Jack Thorne) *Potential automorphy over CM fields*, arxiv:1812:09999, submitted.
7. *Curtis homomorphisms and the integral Bernstein center for $\boldsymbol{GL}_n$*, Algebra and Number Theory **14** (2020), no. 10, 2607–2645.

8. (with Gilbert Moss) *Converse theorems and the local Langlands correspondence in families*, Invent. Math. **214** (2018), 999-1022.
9. (with Liang Xiao and Yichao Tian) *Tate cycles on some unitary Shimura varieties mod p*, Algebra and Number Theory **11** (2017), no. 10, 2213–2288.
10. *Whittaker models and the integral Bernstein center for* $\boldsymbol{GL}_n$, Duke Math. Journal. **165** (2016), no. 9, 1597–1628.
11. *The Bernstein center of the category of smooth* $W(k)[GL_n(F)]$*-modules*, Forum of Mathematics, Sigma **4** (2016), e11.
12. (with Gilbert Moss) *Gamma factors in deformation rings*, preprint, available at arXiv:1510.08743.
13. (with Matthew Emerton) *The local Langlands correspondence for* $\boldsymbol{GL}_n$ *in families*, Ann. Sci. École Norm. Sup. **47** (2014), no. 4, 655–722.
14. *On the modified mod p local Langlands correspondence for* $\boldsymbol{GL}_2(\mathbb{Q}_\ell)$, Math. Res. Lett. **20** (2013), no. 3, 489–500.
15. (with José Felipe Voloch) *Finite descent obstruction on curves and modularity*, Bull. London Math. Soc. 2011.
16. *On l-adic families of cuspidal representations of* $\boldsymbol{GL}_2(\mathbb{Q}_p)$, Math. Res. Lett. **17** (2010), no. 5, 805–822.
17. (with Eric Katz) *Monodromy filtrations and the topology of tropical varieties*, Canad. J. Math. **64** (2012), 845–868.
18. *Towards a geometric Jacquet-Langlands correspondence for unitary Shimura varieties*, Duke Math. J. **155** (2010), no. 3, 483–518.
19. *Mazur's principle for U(2,1) Shimura varieties*, preprint, available at arxiv:math/0606731
20. *A geometric Jacquet-Langlands correspondence for U(2) Shimura varieties*, Israel J. Math. **187** (2012), 37–80.
21. *On maps between modular Jacobians and Jacobians of Shimura curves*, Israel J. Math **160** (2007), 61–117.
22. (with Brian Osserman) *Flatness of the linked Grassmannian*, Proc. Amer. Math. Soc **136** (2008), no. 10, 3383–3390. arxiv:math.AG/0605373
23. (with Ezra Miller) *Algorithms for graded injective resolutions and local cohomology over semigroup rings*, Journal of Symbolic Computation **39**, 373–395. arXiv:math.AC/0309256
24. (with Ezra Miller) *Bass numbers of semigroup-graded local cohomology*, Pacific Journal of Mathematics **209**, no. 1, 41–66. arXiv:math.AG/0010003

Recent Talks:

2021 Mar. Séminaire Groupes Réductifs et Formes Automorphes, Jussieu: A categorical Deligne-Langlands correspondence for split reductive groups over p-adic fields.

2019 Jul. Conference on Recent advances in the arithmetic of Galois representations, Genoa: Moduli of Langlands parameters.

2018 Jul. Workshop on Galois Representations, Heidelberg: Moduli of Langlands parameters.

May London-Paris number theory seminar: Towards a local Langlands correspondence in families for split groups in depth zero.

Apr. Workshop on new developments in automorphic forms, IMUS, Seville: Towards a local Langlands correspondence in families for split groups in depth zero.

2016 Mar. Algebraisation and geometrisation in the Langlands programme, Bristol: The integral Bernstein center for $\mathbf{GL}_n$ and the local Langlands correspondence in families.

Mar. Exeter number theory seminar: The integral Bernstein center for $\mathbf{GL}_n$ and the local Langlands correspondence in families.

Jan. Workshop on categorification and p-adic groups, University of East Anglia: The integral Bernstein center for $\mathbf{GL}_n$ and the local Langlands correspondence in families.

2015 Jun. CIRM conference on Arithmetic Geometry, Representation Theory, and Applications: Whittaker models, converse theorems, and the local Langlands correspondence for $\mathbf{GL}_n$ in families.

Apr. UT number theory seminar: Maximal tori and the integral Bernstein center for $\mathbf{GL}_n$.

Feb. Workshop on Galois Representations, Heidelberg: Moduli of Weil group representations and the local Langlands correspondence in families.

2014 Dec. Imperial College number theory seminar: Maximal tori and the integral Bernstein center for $\mathbf{GL}_n$.

Jun. University of East Anglia: The integral Bernstein center for $\mathbf{GL}_n$.

Jan. Universitat Duisburg-Essen: A derived local Langlands correspondence for $\mathbf{GL}_n$.

2013 Nov. Imperial College number theory seminar: A derived local Langlands correspondence for $\mathbf{GL}_n$.

Oct. Cambridge number theory seminar: The integral Bernstein center for $\mathbf{GL}_n$.

Jul. Jussieu; Séminaire groups réductifs et formes automorphes: A derived local Langlands correspondence for $\mathbf{GL}_n$.

Jun. Jussieu; Séminaire groups réductifs et forms automorphes: The integral Bernstein center and the local Langlands correspondence for $\mathbf{GL}_n$ in families.

May. UCSD number theory seminar: A derived local Langlands correspondence for $\mathbf{GL}_n$.

May. UC Irvine number theory seminar: The integral Bernstein center and the local Langlands correspondence for $\mathbf{GL}_n$ in families.

Apr. National University of Singapore Institute for Mathematical Science: Conference on the modular representation theory of finite and p-adic groups: A derived local Langlands correspondence for $\mathbf{GL}_n$.

Apr. UT number theory seminar: A derived local Langlands correspondence for $\mathbf{GL}_n$.

2012 Dec. UIUC number theory seminar: The integral Bernstein center and the local Langlands correspondence for $\mathbf{GL}_n$ in families.

Oct. University of Chicago number theory seminar: The integral Bernstein center and the local Langlands correspondence for $\mathbf{GL}_n$ in families.

Jul. BIRS conference on Arithmetic and Geometry of Shimura Varieties: The local Langlands correspondence for $\mathbf{GL}_n$ in families.

Mar. MIT: Lie Groups seminar: The Bernstein center of the category of smooth $W(k)[\mathbf{GL}_n(F)]$-modules.

2011 Oct. UT: Local Langlands for families of Galois representations and the Bernstein center.

Apr. IAS: Galois representations and automorphic forms seminar: The Bernstein center of the category of smooth $W(k)[\mathbf{GL}_n(F)]$-modules.

Feb. UT: The Bernstein center of the category of smooth $W(k)[\mathbf{GL}_n(F)]$-modules.

Professional Activities:

- Journals Refereed:

Journal of the American Mathematical Society
Duke Mathematical Journal
Bulletin of the London Mathematical Society
Mathematische Annalen
Journal of Number Theory
Finite Fields and their Applications
Mathematical Research Letters
International Mathematics Research Notices
Mathematics of Computation
NSA Grant Applications

- Departmental service: Imperial College London:

  Fourth-Year projects organizer (2021)
  Chapman Fellowship pure panel organizer (2020,2021)
  Chapman Fellowship interview panelist (pure) (2018,2019)
  LSGNT lead selector for number theory (2017–2021)
  LSGNT admissions committee (Spring 2016)
  Year Tutor (Spring 2016–Spring 2019)
  Pure Maths Exam Section Editor, 2015–2016
  Organizer, London Number Theory Seminar, Autumn 2015
  Interviewer, LSGNT applicants Spring 2015

- Departmental committees served, University of Texas at Austin:

  Administrative Subcommittee of the Graduate Studies Committee (ASGSC) (2012-2013)
  Administrative Subcommittee of the Graduate Studies Committee (ASGSC) (2011-2012)
  Algebra Prelim Committee (2012-2013, University of Texas at Austin)
  Algebra Prelim Committee (2011-2012, University of Texas at Austin)
  Graduate Admissions (algebra and number theory applicants, 2009-10)
  Algebra, Number Theory and Combinatorics Seminar, 2009-10 (with Mirela Ciperiani)
  Algebra Prelim Committee (2009-10, University of Texas at Austin)
  Algebra Prelim Committee (2008-9, University of Texas at Austin)

Postdoctoral Supervision

- Dr. Justin Trias-Batle (Sep. 2021 –)
- Dr. Robert Kurinczuk (Oct. 2016 – Jun. 2021)
- Dr. Jean-Stefan Koskivirta (Oct. 2016 - Oct. 2018)
- Dr. Daniel Skodlerack (Nov. 2015 - Nov. 2016)

Current and Former Students

- Mr. Johannes Girsch (LSGNT, begun Summer 2018)
- Dr. Gilbert Moss (Ph. D. UT Austin, Spring 2015)
- Dr. Mohammad Haque (Ph. D. UT Austin, Summer 2013)
- Dr. David Paige (Ph. D. UT Austin, Summer 2012)
- Dr. Brian Katz (Ph. D. UT Austin, Fall 2011)

Teaching Experience:

2021 Autumn Algebra 3, Imperial College London

2021 Autumn Number Theory, Imperial College London
2020 Autumn Algebra 3, Imperial College London
2020 Autumn Number Theory, Imperial College London
2019 Autumn Algebra 3, Imperial College London
2019 Autumn Modular Forms, Imperial College London
2018 Autumn Algebra 3 (M3/4/5P8), Imperial College London
2018 Autumn Modular Forms (M4/5P58), Imperial College London
2018 Summer Representation theory of $\mathbf{GL}_2$ (TCC course), Imperial College London
2016 Autumn Elementary Number Theory (M3/4/5P14), Imperial College London
2016 Autumn Modular Forms (M4/5P58), Imperial College London
2015 Autumn Elementary Number Theory (M3/4/5P14), Imperial College London
2015 Autumn Modular Forms (M4/5P58), Imperial College London
2014 Autumn Modular Forms (M4/5P58), Imperial College London
2013 Spring Advanced Calculus for Applications II (undergraduate vector calculus), University of Texas
2012 Fall Algebra (graduate), University of Texas
2012 Spring Advanced Calculus for Applications II (undergraduate vector calculus), University of Texas
2011 Fall Algebra (graduate), University of Texas
2011 Spring Modular forms and the Langlands Program (topics course), University of Texas
2010 Fall Advanced Calculus for Applications II (Honors) (undergraduate vector calculus), University of Texas
2010 Spring Matrices and Matrix Computations (undergraduate linear algebra), University of Texas
2009 Fall Theory of Schemes (topics course), University of Texas
2009 Spring Algebra (graduate), University of Texas
2008 Fall Calculus II (undergraduate), University of Texas
2008 Spring Advanced Calculus for Applications II (undergraduate vector calculus), University of Texas
2007 Fall Number Theory (undergraduate), University of Texas
2007 Spring Algebraic Geometry (graduate, first semester); Linear Algebra (undergraduate), Harvard University
2006 Fall Algebraic Geometry (graduate, first semester), Harvard University
2005 Spring Algebraic Geometry (undergraduate), Harvard University
2004 Spring Algebraic Geometry (graduate, second semester), Harvard University
2003 Fall Algebraic Geometry (graduate, first semester), Harvard University
2003 Spring Course Assistant, Algebraic Geometry (graduate, second semester), UC Berkeley
2002 Fall Graduate Student Instructor, Math 1A (calculus), UC Berkeley

Miscellaneous Teaching Activities

2020-2021 M5R project for Rodrigo Lope Prieto - Galois deformation rings and modularity
2020-2021 M5R project for Osmund Justinussen - The Hasse-Minkowski principle
2020-2021 M3R project for Calle Sonne - The Eichler-Shimura construction
Summer 2020 Supervised UROP for Calle Sonne - Arithmetic models for modular curves
2019-2020 M5R project for Bowen Zheng - Modular forms and congruences for the partition function
2019-2020 M5R project for Lilybelle Cowland-Kellock - Herbrand's theorem and its converse
2019-2020 M4R project for Antoine Beraud - L-functions
2018-2019 M5R project for Kai Low - Complex Multiplication

2018-2019	M5R project for Andrew Mendelssohn - Mod p modular forms
2018-2019	M5R project for Xiaohang Xin - Primes in arithmetic progressions
2017-2018	M4R project for Christopher Haines - Class field theory and higher reciprocity
2016-2017	M4R project for Erik Scheriani- Primes of the form $x^2 + ny^2$
2015-2016	M4R project for Yong-Li Loh- Hilbert's tenth problem
Summer 2015	Supervised UROP for Alexander Horawa - Artin L-functions and class field theory
Spring 2015	Informal reading course - Dalton Fung - Class field theory and complex multiplication
2014–2015	M4R project for Mathew Bell - Class field theory and higher reciprocity
2011 Fall	Etale Cohomology seminar (twice weekly seminar co-organized with Hendrik Orem)
2010 Spring	Informal Seminar on Scheme Theory (reading course with twice-weekly student lectures; roughly 8 participants)
2009 Fall	Number Theory Journal seminar (weekly seminar co-organized with Kim Hopkins)
2008 Fall	Algebraic Geometry and Representation theory seminar (weekly seminar co-organized with Carl Mautner)
2007 Fall	Etale Cohomology seminar (twice weekly seminar co-organized with Carl Mautner)

References:

Kenneth A. Ribet (Advisor)
Department of Mathematics
UC Berkeley
Berkeley, CA 94720-3840
ribet@math.berkeley.edu

Richard Taylor
School of Mathematics
Institute for Advanced Study
Einstein Dr.
Princeton, NJ 08540
rtaylor@math.ias.edu

Jean-Francois Dat
Institut de Mathématiques de Jussieu
4 Place Jussieu
75252 Paris cedex 05
jean-francois.dat@imj-prg.fr

Mark Kisin
Department of Mathematics
Harvard University
One Oxford St.
Cambridge, MA 02138
kisin@math.harvard.edu

Matthew Emerton
Department of Mathematics
University of Chicago
5734 S. University Ave.
Chicago, IL 60637
emerton@math.uchicago.edu