

MATTHEW JAMES EMERTON

Curriculum Vitae — January 2023

University of Chicago
Department of Mathematics
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Personal:

Date of Birth: Nov. 9, 1971
Birthplace: Canberra, ACT, Australia
Citizenship: Australian
Residency: United States

Education:

Harvard University: Ph.D., June 1998
University of Melbourne: B.Sc. (Honours), November 1993

Thesis:

2-adic modular forms of minimal slope, May 1998
(Adviser: Professor Barry Mazur, Harvard University)

Awards:

Alfred P. Sloan Foundation Doctoral Dissertation Fellowship, 1997-98 academic year
Rackham School of Graduate Studies Summer Faculty Fellowship, Summer 1999

Research Interests:

Number Theory
Representation Theory
Algebraic Geometry

Appointments:

Professor
Department of Mathematics, University of Chicago
Chicago, Illinois, United States
September 2011 – present

Arthur Anderson Teaching and Research Professor
Northwestern University
Evanston, Illinois, United States
September 2010 – August 2011

Professor
Department of Mathematics, Northwestern University
Evanston, Illinois, United States
September 2008 – August 2011

Associate Professor
Department of Mathematics, Northwestern University
Evanston, Illinois, United States
September 2005 – August 2008

Assistant Professor
Department of Mathematics, Northwestern University
Evanston, Illinois, United States
June 2001 – August 2005

Assistant Professor
Department of Mathematics, University of Chicago
Chicago, Illinois, United States
July 2000 – June 2001

Assistant Professor
Department of Mathematics, University of Michigan
Ann Arbor, Michigan, United States
September 1998 – July 2000

Research Grants:

National Science Foundation award no. DMS-2201242
Project title: Arithmetic Aspects of the Langlands Program
Project period: July 1, 2022 – June 30, 2025
Principal investigator: Matthew Emerton
Grant amount: \$390,000

National Science Foundation award no. DMS-1952705
Project title: FRG: Collaborative Research: Geometric structures in the p -adic Langlands program
Project period: July 1, 2020 – June 30, 2023
Principal investigators: Matthew Emerton, Bao Viet Le Hung, Brandon Levin, Michael Harris,
David Savitt
Grant amount: \$303,394

National Science Foundation award no. DMS-1902307
Project title: Automorphic forms and Galois representations
Project period: July 1, 2019 – June 30, 2022
Principal investigator: Matthew Emerton
Grant amount: \$390,000

National Science Foundation award no. DMS-1601871
Project title: p -adic aspects of the Langlands program
Project period: June 1, 2016 – May 31, 2019
Principal investigator: Matthew Emerton
Grant amount: \$330,000

National Science Foundation award no. DMS-1303450
Project title: p -adic aspects of the Langlands program
Project period: June 1, 2013 – May 31, 2016
Principal investigator: Matthew Emerton
Grant amount: \$320,000

National Science Foundation award no. DMS-1101503
Project title: Special meeting: Galois representations, Diophantine equations, and automorphic forms
Project period: September 15, 2011 – August 31, 2012
Principal investigator: Matthew Emerton
Grant amount: \$80,000

National Science Foundation award no. DMS-1002339, DMS-1249548
Project title: p -adic aspects of the Langlands program
Project period: June 1, 2010 – May 31, 2013
Principal investigator: Matthew Emerton
Grant amount: \$240,000

National Science Foundation award no. DMS-0636646

Project title: Geometry and physics

Project period: February 2007 – February 2012.

Principal investigators: Ezra Getzler, Boris Tsygan, Eric Zaslow

Co-investigators: Kevin Costello, Matthew Emerton, Yuri Manin, David Nadler, Dimitri Tamarkin,
Kari Vilonen, Jared Wunsch

Grant amount: \$1,290,080

National Science Foundation award no. DMS-0701315

Project title: p -adic aspects of the Langlands program

Project period: June 1, 2007 – May 31, 2010

Principal investigator: Matthew Emerton

Grant amount: \$186,002

National Science Foundation award no. DMS-0401545

Project title: Locally analytic representation theory and p -adic interpolation

Project period: June 1, 2004 – May 31, 2007

Principal investigator: Matthew Emerton

Grant amount: \$185,904

National Science Foundation award nos. DMS-0070711, DMS-0296095, DMS-0241562

Project title: A p -adic Riemann-Hilbert correspondence

Project period: July 1, 2000 – June 30, 2004

Principal investigator: Matthew Emerton

Grant amount: \$79,324

Programs organized:

Workshop on Modularity and Moduli spaces (with Rebecca Bellovin, Brandon Levin, and David Savitt, CMO, October 2019)

Clay Workshop on Modular Representation Theory (with Ivan Losev and Geordie Williamson, Oxford, September/October 2019)

Mathematics is a Long Conversation: A Celebration of Barry Mazur (with Dennis Gaitsgory, Michael Harris, Mark Kisin, and Karl Rubin, June 2018)

Workshop on Cohomology of Shimura Varieties: Arithmetic Aspects and Construction of Galois Representations (with Laurent Clozel, David Geraghty, and Sug Woo Shin, Fields Institute, March 2012)

Thematic Program on Galois Representations (with Frank Calegari, Florian Herzig, Mark Kisin, and Steve Kudla, Fields Institute, January/June 2012)

Physics Mathematics Summer Institute (with Roman Bezrukavnikov, Ivan Cherednik, Patrick Delorme, Michael Douglas, Pavel Etingof, Anton Kapustin, Vladimir Kazakov, Maxim Kontsevich, Juan Maldacena, Barry Mazur, Ivan Mirkovic, Oleg Ogievetsky, Eric Opdam, Didina Serban, and Jean-Bernard Zuber, Luminy and Cargese, June/July 2011)

Conference on Current Developments and Directions in the Langlands Program (with Frank Calegari and Yuri Manin, Northwestern, May 2008)

Graduate Student Workshop on Representation Theory and Arithmetic (with Frank Calegari, Northwestern, May 2008)

Workshop on p -adic Variation of Motives (with Kevin Buzzard, Robert Coleman, and Eyal Goren, BIRS, December 2003)

Students (past and present):

Nazerke Bakytzhan, Andrea Carter, Anthony Santiago Chaves Aguilar, Chuangxun Cheng, Yun Cheng, Lisa Clay, Tianqi Fan, Mathilde Gerbelli-Gauthier, Sean Howe, Casimir Kothari, Yulia Kotelnikova, Iason Kountouridis, Daniel Le, Hao Billy Lee, Ray Li, Bingjin Liu, Kun Liu, Chang Mou Lim, Jeffery Manning, Drew Moore, Michael Neaton, Gal Porat, Karl Schaefer, Jack Sempliner, Yiwei She, Samanta Zhang, Yiwen Zhou

Postdocs Mentored (past and present):

George Boxer, Ana Caraiani, Andrea Dotto, Ellen Eischen, Toby Gee, Florian Herzig, P. Edward Herman, Brian Lawrence, Bao Viet Le Hung, Brandon Levin, Lucia Moczz, Lue Pan, Davide Reduzzi, Daniil Rudenko, Jack Shotton, Liang Xiao, Zijian Yao, Bei Zhang

Publications:

An introduction to the categorical p -adic Langlands program (joint with Eugen Hellmann and Toby Gee), available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 239 pages.

Localization of smooth p -power torsion representations of $\mathrm{GL}_2(\mathbf{Q}_p)$ (joint with Andrea Dotto and Toby Gee), available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 64 pages.

Explicit reciprocity laws and Iwasawa theory for modular forms (joint with Robert Pollack and Tom Weston), available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 49 pages.

Moduli stacks of étale (φ, Γ) -modules: a survey (joint with Toby Gee), to appear in Proceedings of the International Colloquium on Arithmetic Geometry, TIFR Mumbai, January 6–10, 2020, available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 59 pages.

Moduli stacks of étale (φ, Γ) -modules and the existence of crystalline lifts (joint with Toby Gee), Annals of Mathematics Studies (No. 215), Princeton University Press, 2023, ix+298 pp.

Langlands reciprocity: L -functions, automorphic forms, and Diophantine equations, in The Genesis of the Langlands Program (Julia Mueller and Freydoon Shahidi eds.), London Mathematical Society Lecture Notes Series (No. 467), Cambridge University Press, 2021, 301–386.

Formal algebraic stacks, available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 93 pages.

Moduli stacks of two-dimensional Galois representations (joint with Ana Caraiani, Toby Gee, and David Savitt), available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 123 pages.

Globally realizable components of local deformation rings (joint with Frank Calegari and Toby Gee), Journal of the Institute of Mathematics of Jussieu, vol. 21 (2022), 533–602.

“Scheme-theoretic images” of morphisms of stacks (joint with Toby Gee), Algebraic Geometry, vol. 8 (2021), 1–132.

On the density of supercuspidal points of fixed weight in local deformation rings and global Hecke algebras (joint with Vytautas Paskunas), Journal d’École Polytechnique — Mathématiques, vol. 7 (2020), 337–371.

Compatible systems of Galois representations associated to the exceptional group E_6 (joint with George Boxer, Frank Calegari, Brandon Levin, Keerthi Madapusi Pera, and Stefan Patrikis), Forum of Mathematics. Sigma, vol. 7 (2019), 29 pages.

Patching and the p -adic local Langlands program for $\mathrm{GL}_2(\mathbf{Q}_p)$ (joint with Ana Caraiani, Toby Gee, David Geraghty, Vytautas Paškūnas, and Sug Woo Shin), Compositio Mathematica, vol. 154 (2018), 503–548.

Unramifiedness of Galois representations arising from Hilbert modular surfaces (joint with Davide Reduzzi and Liang Xiao), Forum of Mathematics. Sigma, vol. 5 (2017), 70 pages.

Explicit Serre weights for two-dimensional Galois representations (joint with Frank Calegari, Toby Gee, and Lambros Mavrides), Compositio Mathematica, vol. 153 (2017), 1893–1907.

Galois representations and torsion in the coherent cohomology of Hilbert modular varieties (joint with Davide Reduzzi and Liang Xiao), Crelle’s Journal, vol. 276 (2017), 93–127.

Patching and the p -adic local Langlands correspondence (joint with Ana Caraiani, Toby Gee, David Geraghty, Vytautas Paškūnas, and Sug Woo Shin), Cambridge Journal of Mathematics, vol. 4 (2016), 197–287.

Homological stability for completed homology (joint with Frank Calegari), Mathematische Annalen, vol. 364 (2016), 1025–1041.

Lattices in the cohomology of Shimura curves (joint with Toby Gee and David Savitt), Inventiones Mathematicae, vol. 200 (2015), 1–96.

p -adic Hodge-theoretic properties of étale cohomology with mod p coefficients, and the cohomology of Shimura varieties (joint with Toby Gee), Algebra and Number Theory, vol. 9 (2015), 1035–1088.

Local-global compatibility in the p -adic Langlands programme for GL_2/\mathbf{Q} , available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 119 pages.

On a class of coherent rings, with applications to the smooth representation theory of $\mathrm{GL}_2(\mathbf{Q}_p)$ in characteristic p , available electronically at <http://math.uchicago.edu/~emerton/preprints.html>, 13 pages.

Completed cohomology and the p -adic Langlands program, Proceedings of the 2014 ICM, Vol. II, 319–342.

A geometric perspective on the Breuil–Mézard conjecture (joint with Toby Gee), Journal of the Institute of Mathematics of Jussieu, vol. 13 (2014), 183–223.

The local Langlands correspondence for GL_n in families (joint with David Helm), Annales Scientifiques de L’École Normale Supérieure (4), vol. 47 (2014), 655–722.

Weight cycling and Serre-type conjectures for unitary groups (joint with Toby Gee and Florian Herzig), Duke Mathematical Journal, vol. 162 (2013), 1649–1722.

Completed cohomology — A survey (joint with Frank Calegari), in Nonabelian Fundamental Groups and Iwasawa Theory (John Coates, Minhyong Kim, Florian Pop, Mohamed Saidi, Peter Schneider eds.), London Mathematical Society Lecture Notes Series (No. 393), Cambridge University Press, 2011, 239–257.

Mod- p cohomology growth in p -adic analytic towers of 3-manifolds (joint with Frank Calegari), Groups, Geometry, and Dynamics, vol. 5 (2011), 355–366.

p -adic families of modular forms [after Hida, Coleman, and Mazur], Séminaire Bourbaki, 2009/2010, exposé 1013, Astérisque, vol. 339 (2011), 31–61.

Jacquet modules of locally analytic representations of p -adic reductive groups II. The relation to parabolic induction, to appear in the Journal of the Institute of Mathematics of Jussieu, 80 pages.

On the effaceability of certain δ -functors (joint with Vytautas Paškūnas), Astérisque, vol. 331 (2010), 439–447.

Ordinary parts of admissible representations of p -adic reductive groups II. Derived functors, Astérisque, vol. 331 (2010), 383–438.

Ordinary parts of admissible representations of p -adic reductive groups I. Definition and first properties, Astérisque, vol. 331 (2010), 335–381.

Bounds for multiplicities of unitary representations of cohomological type in spaces of cusp forms (joint with Frank Calegari), Annals of Mathematics, vol. 170 (2009), 1437–1446.

Représentations p -adique ordinaires de $\mathrm{GL}_2(\mathbf{Q}_p)$ et compatibilité local-global (joint with Christophe Breuil), Astérisque, vol. 331 (2010), 235–295.

Elliptic curves of odd modular degree (joint with Frank Calegari), Israel Journal of Mathematics, vol. 169 (2009), pp. 417–444.

Locally analytic representation theory of p -adic reductive groups: A summary of some recent developments, in L -functions and Galois representations (D. Burns, K. Buzzard and J. Nekovář, eds.), London Mathematical Society Lecture Note Series, vol. 320, 2007, 407–437.

A report on the AIM working group on mod p local Langlands, available electronically at <http://www.aimath.org/WWN/padicmodularity>, 6 pages.

A local-global compatibility conjecture in the p -adic Langlands programme for GL_2/\mathbf{Q} , Pure and Applied Mathematics Quarterly, vol. 2 (2006), no. 2 (Special issue: In honour of John Coates’ 60th birthday, part 2 of 2), pp. 279–393.

Jacquet modules of locally analytic representations of p -adic reductive groups I. Construction and first properties, Annales Scientifiques de L’École Normale Supérieure, vol. 39 (2006), 775–839.

On the interpolation of systems of eigenvalues attached to automorphic Hecke eigenforms, Inventiones Mathematicae, vol. 164 (2006), pp. 1–84.

Variation of Iwasawa invariants in Hida families (joint with Robert Pollack and Tom Weston), Inventiones Mathematicae, vol. 163 (2006), pp. 523–580.

p -adic L -functions and unitary completions of representations of p -adic reductive groups, Duke Mathematical Journal, vol. 130 (2005), 353–392.

Locally analytic vectors in representations of locally p -adic analytic groups, *Memoirs of the American Mathematical Society*, vol. 248 (2017), 158 pages.

On the ramification of Hecke algebras at Eisenstein primes (joint with Frank Calegari), *Inventiones Mathematicae*, vol. 160 (2005), pp. 97–144.

A geometric Jacquet functor (joint with David Nadler and Kari Vilonen), *Duke Mathematical Journal*, vol. 125 (2004), pp. 267–278.

An introduction to the Riemann-Hilbert correspondence for unit F -crystals (joint with Mark Kisin), in *Geometric aspects of Dwork theory* (A. Adolphson, etc., eds.), vol. II, Walter de Gruyter, Berlin and New York, 2004, pp. 677–700.

The Riemann-Hilbert correspondence for unit F -crystals (joint with Mark Kisin), *Astérisque*, vol. 293 (2004), 251 pages.

The Hecke algebra \mathbf{T}_k has large index (joint with Frank Calegari), *Mathematical Research Letters*, vol. 11 (2004), 125–137.

Optimal quotients of modular Jacobians, *Mathematische Annalen*, vol. 327 (2003), 429–458.

Supersingular elliptic curves, theta series and weight two modular forms, *Journal of the American Mathematical Society*, vol. 15 (2002), 671–714.

An introduction to the p -adic geometry of modular curves, appendix to F. Q. Gouvêa, *Deformations of Galois representations*, in *Arithmetic Algebraic Geometry* (B. Conrad and K. Rubin, eds.), IAS/Park City Mathematics Series, vol. 9, 2001, 377–398.

Unit L -functions and a conjecture of Katz (joint with Mark Kisin), *Annals of Mathematics*, vol. 153 (2001), 329–354.

The Eisenstein ideal in Hida's ordinary Hecke algebra, *International Mathematics Research Notices* (1999) no. 15, 793–802.

A new proof of a theorem of Hida, *International Mathematics Research Notices* (1999) no. 9, 453–472.

Extensions of crystalline representations (joint with Mark Kisin), *Preprintreihe, SFB 478 - Geometrische Strukturen in der Mathematik*, 1999, 50 pages.

Selected Invited Talks:

Week-long lecture series at the *Hausdorff School on the Emerton–Gee stack and related topics*, Bonn, September 2019

The p -adic Langlands program, Sixth Abel Conference: A Mathematical Celebration of Robert P. Langlands, Minnesota, November 2018

Completed cohomology and the p -adic Langlands program, International Congress of Mathematicians, Seoul, August 2014

An overview of the p -adic Langlands program, Gelfand Centennial Conference, MIT, August/September 2013

Galois representations and automorphic forms, Hahn Lecture Series, Yale, February 2011

p -adic families of modular forms [after Hida, Coleman, and Mazur], Séminaire Bourbaki, Paris, November 2009

Topology, representation theory, and arithmetic: Three-manifolds and the Langlands program, Current Events Bulletin, Joint Mathematics Meeting, Washington DC, January 2009