

# Ana Caraiani

---

## CONTACT INFORMATION

Department of Mathematics  
Imperial College London  
180 Queen's Gate  
London SW7 2AZ, UK

*Email:* a.caraiani@imperial.ac.uk  
*WWW:* wwwf.imperial.ac.uk/~acaraian

## RESEARCH INTERESTS

The Langlands program, algebraic number theory, arithmetic geometry, representation theory.

## EDUCATION

**Ph.D. in Mathematics**, Harvard University 9/2007–6/2012

- Thesis: Local-global compatibility and the action of monodromy on nearby cycles
- Advisor: Richard Taylor

**B.A. in Mathematics**, Summa cum Laude, Princeton University 9/2003–6/2007

## EMPLOYMENT

**Royal Society University Research Fellow and Reader**, Imperial College London 9/2019–

**Royal Society University Research Fellow and Senior Lecturer**, Imperial College London 8/2017–8/2019

**Bonn Junior Fellow**, Hausdorff Center for Mathematics 8/2016–8/2017

**Veblen Research Instructor and NSF Postdoctoral Fellow**, Princeton University and Institute for Advanced Study 9/2013–7/2016

**L.E. Dickson Instructor and NSF Postdoctoral Fellow**, University of Chicago 9/2012–8/2013

## VISITING POSITIONS

**Bonn Research Fellow**, Hausdorff Center for Mathematics 10/2018–9/2024

## PUBLICATIONS AND PREPRINTS

1. “Vanishing theorems for Shimura varieties at unipotent level”, joint with D. Gulotta and C. Johansson, arXiv:1910.09214, 37 pages, submitted.
2. “On the generic part of the cohomology of non-compact unitary Shimura varieties”, joint with P. Scholze, arXiv:1909.01898, 87 pages, submitted.
3. “Moduli stacks of 2-dimensional Galois representations, joint with M. Emerton, T. Gee and D. Savitt, arXiv:1908.07019, 123 pages, submitted.
4. “Potential automorphy over CM fields”, joint with P. Allen, F. Calegari, T. Gee, D. Helm, B. Le Hung, J. Newton, P. Scholze, R. Taylor, and J. Thorne, arXiv:1812.09999, 192 pages, submitted.
5. “Shimura varieties at level  $\Gamma_1(p^\infty)$  and Galois representations”, joint with D. Gulotta, C.Y. Hsu, C. Johansson, L. Mocz, E. Reinecke and S.C. Shih, *Compositio Math.* 156 (2020), 1152–1230.
6. “Perfectoid Shimura varieties”, in *Perfectoid spaces: Lectures from the 2017 Arizona Winter School*, edited by Bryden Cais, Mathematical Surveys and Monographs 242, American Mathematical Society, 2019.
7. “Patching and the  $p$ -adic Langlands program for  $GL_2(Q_p)$ ”, joint with M. Emerton, T. Gee, D. Geraghty, V. Paskunas and S.W. Shin, *Compositio Math.* 154 (2018), no. 3, 503–548.
8. “Kisin modules with descent data and parahoric local models”, joint with B. Levin, *Ann. Sci. École Norm. Sup.*, 4e série, 51 (2018), 181–213.

9. “On the generic part of the cohomology of compact unitary Shimura varieties”, joint with P. Scholze, *Annals of Math.* 186 (2017), no. 3, 647–766.
10. “ $p$ -adic  $q$ -expansion principles on unitary Shimura varieties”, joint with E. Eischen, J. Fintzen, E. Mantovan and I. Varma, *Directions in Number Theory: Proceedings of the WIN3 Workshop* (2016), Springer, 197-244.
11. “On the image of complex conjugation in certain Galois representations”, joint with B.V. Le Hung, *Compositio Math.* 152 (2016), No. 7, 1476-1488.
12. “Patching and the  $p$ -adic local Langlands correspondence”, joint with M. Emerton, T. Gee, D. Geraghty, V. Paskunas and S.W. Shin, *Cambridge Journal of Math.* 4 (2016), No. 2, 197-287.
13. “Local-global compatibility and monodromy for  $l = p$ ”, *Algebra & Number Theory* 8 (2014), no. 7, 1597-1646.
14. “Local-global compatibility and the action of monodromy on nearby cycles”, *Duke Mathematical Journal* 161 (2012), no. 12, 2311-2413.
15. “Multiplicative semigroups related to the  $3x + 1$  problem”, *Adv. Appl. Math.* 45 (2010), no. 3, 373-389.

#### GRANTS

- ERC Starting Grant “ $p$ -adic arithmetic geometry, torsion classes, and modularity”, €1,469,805.00 2019-2024
- Royal Society Research Grant for Research Fellows, £92,148.00 2018-2022
- Royal Society University Research Fellowship, £450,094.81 2017–2022
- NSF Grant DMS-1501064 (PI), \$159,469 2015–2017
- NSF Mathematical Sciences Postdoctoral Research Fellowship, \$150,000 2012–2015

#### SELECTED AWARDS AND HONORS

- Prize of the European Mathematical Society 2020
- Fellow of the American Mathematical Society 2020
- President’s Award for Outstanding Early Career Research, Imperial College 2019
- Whitehead Prize, London Mathematical Society 2018
- Von Neumann Fellowship, IAS (declined in order to go on maternity leave) Spring 2018
- James Mills Peirce Fellowship for Graduate Study, Harvard University 2007-2010
- William Lowell Putnam Fellowship for Graduate Study, Harvard University 2007-2009
- George B. Covington Prize, Department of Mathematics, Princeton University 2007
- Middleton Miller Prize, Department of Mathematics, Princeton University 2007
- Alice T. Schafer Prize, Association for Women in Mathematics 2007
- Member of 1st place Putnam team 2006
- Andrew H. Brown Prize, Department of Mathematics, Princeton University 2006
- Putnam Fellow and Elizabeth Lowell Putnam Prize 2003, 2004
- Gold Medal, International Mathematical Olympiad 2002, 2003
- Silver Medal, International Mathematical Olympiad 2001

TEACHING EXPERIENCE	· Teaching accreditation: Fellow of the Higher Education Academy	September 2019
	· Algebraic number theory (M3P15), Imperial College London	Spring 2019
	· Seminar on the Weil Conjectures, University of Bonn	Summer 2017
	· Étale cohomology, University of Bonn	Winter 2016/2017
	· Linear algebra and applications (MAT202, 2 sections), Princeton University	Spring 2015
	· Topics in Number Theory: Introduction to Modular Forms and $L$ -functions (MAT 419), Princeton University	Spring 2014
	· Numbers, Equations and Proofs (MAT214), Princeton University	Fall 2013
	· Linear algebra and differential equations (Math 21b, 2 sections), Harvard University	Spring 2012
	· Multivariable calculus (Math 21a), Harvard University	Fall 2008, 2009, 2010
	MAJOR INVITED LECTURES	· AMS Current Events Bulletin, AMS/MAA Joint Math Meetings (upcoming)
· Plenary talk, Journées Arithmétiques, Caen, France		July 2017
· Arizona Winter School, minicourse (4 talks)		March 2017
· Sophus Lie Days, Cornell (2 talks)		April 2015
· MSRI/Evans lecture, Berkeley		November 2014
MINICOURSES	· School in Arithmetic Geometry, Essen (5 hours)	September 2018
	· Algebraic Groups and Geometrization of Local Langlands, ENS Lyon (4 hours)	June 2018
	· UK–Japan Winter School 2018 on Number Theory (2 talks)	January 2018
	· Texel Island Summer School (4 talks)	August 2017
	· Arizona Winter School (4 talks)	March 2017
	· The Langlands correspondence in arithmetic and geometry, KIAS, (5 talks)	August 2016
OTHER INVITED TALKS	· University of Minnesota Colloquium (upcoming)	November 2020
	· Berkeley–Caltech–Stanford number theory seminar (upcoming)	November 2020
	· MIT number theory seminar (upcoming)	November 2020
	· ETH number theory seminar (upcoming)	October 2020
	· Recent Advances in Modern $p$ -adic Geometry	August 2020
	· Cross-Atlantic Representation Theory and Other Topics	May 2020
	· Princeton/IAS number theory seminar	April 2020
	· Warwick number theory seminar	February 2020
	· Arithmetic study group, Durham	January 2020
	· Guest talk in Paris study group	January 2020
	· International Colloquium on Arithmetic Geometry, Tata Institute, Mumbai	January 2020
	· Zürich colloquium in mathematics	November 2019
	· Modular representation theory, Clay Math Institute, Oxford	October 2019
	· University of Bonn Arbeitsgemeinschaft Arithmetische Geometrie seminar	July 2019
	· Arithmetic Geometry in Carthage, Tunisia	June 2019
· Program on Serre conjectures and the $p$ -adic local Langlands program, Padova	June 2019	

· Cambridge number theory seminar	April 2019
· Caltech number theory seminar	April 2019
· Colloquium, Caltech	April 2019
· UCLA number theory seminar	April 2019
· Hot Topics: Recent progress in the Langlands program, MSRI (2 talks)	April 2019
· Colloquium, University of Sheffield	February 2019
· Algebraic groups, Lie algebras, and their representations, Max Planck Institute for Mathematics, Bonn	November 2018
· Oxford number theory seminar	November 2018
· Plenary talk, Young Researchers in Algebraic Number Theory, Sheffield	November 2018
· Cohomology of algebraic varieties, Luminy	October 2018
· Special seminar, University of Regensburg	July 2018
· Swiss Number Theory Days 2018, Basel	June 2018
· Séminaire de Géométrie Arithmétique Paris–Pékin–Tokyo, IHES	January 2018
· Instruments of algebraic geometry, Bucharest, Romania	September 2017
· Max Planck Number Theory seminar	July 2017
· Darmstadt Algebra seminar	July 2017
· University of Bonn Arbeitsgemeinschaft Arithmetische Geometrie seminar (2 talks)	June 2017
· $p$ -adic Hodge theory and automorphic forms, Beijing	June 2017
· Dutch Intercity number theory seminar, Amsterdam	May 2017
· Simons Symposium on $p$ -adic Hodge theory	May 2017
· Modularity and diophantine equations: Exploring Wiles's universe, Barcelona Mathematical Days	April 2017
· University of Zürich number theory seminar	April 2017
· Arbeitsgemeinschaft: Higher Gross Zagier Formulas, Oberwolfach	April 2017
· Local zeta functions and the arithmetic of moduli spaces: a conference in memory of Jun-Ichi Igusa, Johns Hopkins University	March 2017
· Colloquium, Oxford	March 2017
· Essen Oberseminar	February 2017
· Special session on Automorphic forms and arithmetic, JMM, Atlanta	January 2017
· Deformation theory, completed cohomology, Leopoldt conjecture and $K$ -theory, Luminy	December 2016
· London-Paris number theory seminar, Paris	November 2016
· Members' seminar, IAS	October 2016
· University of Bonn Arbeitsgemeinschaft Arithmetische Geometrie seminar	October 2016
· Arithmetic geometry, Oberwolfach	August 2016
· Geometric methods in the mod $p$ Langlands correspondence, Pisa (2 talks)	June 2016
· Workshop on Shimura varieties and related topics, Taipei	June 2016
· Workshop on the $p$ -adic Langlands program and related topics, Indiana University, Bloomington	May 2016
· Advances in geometric representation theory, University of Michigan (2 talks)	May 2016

· Arbeitsgemeinschaft: The geometric Langlands conjecture, Oberwolfach	April 2016
· Colloquium, UCLA	March 2016
· UCLA number theory seminar	March 2016
· Colloquium, Yale	February 2016
· Colloquium, University of Wisconsin	January 2016
· Special mathematics seminar, MIT	January 2016
· Colloquium, University of Washington	January 2016
· Colloquium, Berkeley	January 2016
· Colloquium, UC Irvine	January 2016
· Northwestern number theory seminar	January 2016
· UCSD number theory seminar	January 2016
· Colloquium, UCSD	January 2016
· BU number theory seminar	January 2016
· Colloquium, University of Toronto	January 2016
· Hausdorff Center for Mathematics seminar, Bonn	December 2015
· Colloquium, UIUC	December 2015
· UT Austin number theory seminar	December 2015
· IAS Members' Seminar	December 2015
· Colloquium, Michigan State University	December 2015
· Colloquium, University of Pennsylvania	December 2015
· Colloquium, Rice University	December 2015
· Colloquium, Boston College	December 2015
· Michigan Group, Lie and Number theory seminar	November 2015
· Colloquium, University of Southern California	November 2015
· Colloquium, University of Notre Dame	November 2015
· University of Minnesota Lie Theory seminar	November 2015
· Colloquium, University of Minnesota	November 2015
· University of Pennsylvania Algebra seminar	November 2015
· Harvard/MIT Algebraic Geometry seminar	October 2015
· BU Number theory seminar	October 2015
· Joint Columbia-CUNY-NYU number theory seminar	October 2015
· Wisconsin number theory seminar	October 2015
· University of Chicago number theory seminar	October 2015
· Northwestern number theory seminar	October 2015
· AMS Central Fall Sectional Meeting (Chicago, IL), special session on The Langlands program and related topics	October 2015
· Motives and automorphic forms, Clay Math Institute, Oxford	September 2015
· Johns Hopkins number theory seminar	September 2015
· Algebraic Geometry Bootcamp, University of Utah	July 2015
· Around Langlands correspondences, Université Paris Sud, Orsay	June 2015
· Journées arithmétiques a Lyon, ÉNS Lyon	June 2015

· IAS Program for Women and Mathematics, Princeton Day	May 2015
· $p$ -adic methods in the theory of classical automorphic forms, CRM, Montreal	March 2015
· UCLA number theory seminar	December 2014
· Automorphic forms, Shimura varieties, Galois representations and $L$ -functions (Michael Harris' 60th birthday conference), MSRI	December 2014
· UT Austin number theory seminar	November 2014
· Bay Area Number Theory and Arithmetic Geometry Day, Berkeley	November 2014
· Connections for Women: New Geometric Methods in Number Theory and Automorphic Forms, MSRI	August 2014
· Algebraische Zahlentheorie, Oberwolfach	July 2014
· Arithmetique des varietes de Shimura et des formes automorphes et Applications, Luminy, France	July 2014
· University of Bonn Arbeitsgemeinschaft Arithmetische Geometrie seminar	June 2014
· Caltech number theory seminar	May 2014
· Johns Hopkins and University of Maryland Algebra and Number Theory Day	April 2014
· Hot Topics Workshop on Perfectoid Spaces, MSRI	February 2014
· Princeton/IAS number theory seminar	December 2013
· Princeton junior number theory seminar (2 talks)	December 2013
· CUNY collaborative number theory seminar	November 2013
· University of Pennsylvania Galois seminar	November 2013
· Purdue number theory seminar	April 2013
· University of Chicago number theory seminar	April 2013
· Stanford number theory seminar	April 2013
· UIUC number theory seminar	March 2013
· Colloquium, Caltech	March 2013
· Southern California Number Theory Days	March 2013
· UT Austin number theory seminar	March 2013
· AWM Workshop, JMM, San Diego	January 2013
· UIC number theory seminar	November 2012
· Workshop on $p$ -adic cohomology and its applications to arithmetic geometry, Tohoku University, Sendai, Japan	October 2012
· Towards a local proof of Local Langlands workshop, UIC (2 lectures)	May 2012
· BU number theory seminar	March 2012
· Workshop on Shimura varieties, Fields Institute, Toronto	March 2012
· Workshop for graduate students, Fields Institute, Toronto (2 lectures)	March 2012
· University of Michigan Lie groups and number theory seminar	March 2012
· University of Pennsylvania Galois seminar	February 2012
· MIT number theory seminar	February 2012
· Caltech number theory seminar	December 2011
· University of Chicago number theory seminar	October 2011
· Northwestern number theory seminar	October 2011

	· Harvard number theory seminar	October 2011
	· Workshop on Shimura varieties and Rapoport-Zink spaces, Tokyo, Japan	July 2011
	· Automorphic forms seminar, Jussieu	June 2011
	· Workshop on Galois representations and automorphic forms, IAS	March 2011
	· Galois representations seminar, IAS	January 2011
	· Program for Women and Mathematics, Institute for Advanced Study	May 2007
CONFERENCE ORGANISATION	· Co-organiser (with Ahmed Abbes, Ariane Mézard, Takeshi Saito, Takeshi Tsuji, and Weizhe Zheng), Franco-Asian Summer School on Arithmetic Geometry, Luminy	May 2022
	· Member of the Scientific Committee for Journées Arithmétiques	July 2021
	· Co-organiser (with Frank Calegari, Laurent Fargues, and Peter Scholze) of the Hausdorff Trimester Program “The arithmetic of the Langlands Program”, HIM, Bonn. This included the organization of one summer school and two major conferences. The program was cancelled due to Covid-19.	Summer 2020
	· Co-organizer (with Eran Assaf, Fred Diamond, and James Newton), Workshop on $p$ -adic Langlands, London	May 2019
	· Co-organizer (with Frank Calegari and Richard Taylor), Special session on “Automorphic forms and arithmetic”, Joint Math Meetings, Atlanta, GA	January 2017
	· Co-organizer (with Richard Taylor), Workshop on Emerging Topics: Torsion classes and modularity, IAS	November 2016
PROFESSIONAL SERVICE	· Editor, International Mathematical Research Notices	January 2020–
	· External examiner for the PhD thesis of Zhiyou Wu, Cambridge University	October 2019
	· External examiner for the PhD thesis of Ben Heuer, King’s College London	August 2019
	· Advised Timo Noethel’s Erasmus Bachelor Thesis, Humboldt University	Summer 2019
	· Member of the Royal Society International Exchanges Committee	2019–2020
	· Co-organizer, London–Paris Number Theory Seminar	Spring 2019–
	· Co-organizer, London Number Theory Seminar	Fall 2018–
	· Co-organizer, London Number Theory Study Group	Fall 2017–
	· Member of Chapman hiring committee at Imperial College London	2017–2018
	· Organized a reading course on Shimura varieties, University of Bonn	Summer 2017
	· AMS-Simons Travel Grant committee (Chair 2018-2019)	2017–2020
	· Ad hoc reviewer for the NSF, ERC, EPSRC	2017–
	· Panel member for National Science Foundation review panel	2016–17
	· Member of the jury for the PhD defense of Macarena Peche Irissarry, Université Pierre et Marie Curie	November 2016
	· Co-organizer, Princeton/IAS number theory seminar	2013–2014, 2015–2016
	· Advised Siyan Daniel Li’s junior project on “The zeta function of a modular curve”, Princeton University	Spring 2016
	· Reader for Ila Varma’s PhD thesis on Local-Global Compatibility, Princeton University	Summer 2015
	· Advised Siyan Daniel Li’s summer project on Perfectoid Spaces, Princeton University	Summer 2015

- Reader for Isabelle Nogues's senior thesis on  $p$ -adic Analysis, Princeton University Spring 2015
- Co-organizer, MSRI graduate student working seminar on "The geometric Satake correspondence" Fall 2014
- Co-leader, Women in Numbers 3, Banff Spring 2014
- Co-leader, Women in Numbers Europe, Luminy Fall 2013
- Advised Isabelle Nogues's junior project on Elliptic Curve Cryptography, Princeton University Spring 2014
- Referee for Journal of the AMS, Duke Math. J., Compositio, Forum of Math. Sigma, Math. Annalen, IMRN, Journal of Algebraic Geometry etc. 2013-present
- Served on professional development panels (at Algebraic Geometry Bootcamp, MSRI, Princeton, University of Chicago) 2013-present
- Co-organizer and co-founder, Women in Math Lunches, Harvard University 2008-2012

OUTREACH TALKS

- Invited speaker, LMS Prospects in Mathematics, University of Bath September 2020
- Invited Speaker, European Girls' Math Olympiad, Busteni, Romania April 2016
- Invited Speaker, Women in Math and Statistics, Harvard April 2016