

# Ana Caraiani

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## 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 Laudae, Princeton University 9/2003–6/2007

- Senior thesis: On the modularity of certain Galois representations
- Senior thesis advisor: Andrew Wiles

## EMPLOYMENT

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

**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 10/2018–9/2023

## PUBLICATIONS AND PREPRINTS

1. “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, arXiv:1804.00136, 85 pages.
2. “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, *Compos. Math.* 154 (2018), no. 3, 503–548.
3. “Kisin modules with descent data and parahoric local models”, joint with B. Levin, *Ann. Sci. École Norm. Sup.*, 4e série, 51 (2018), 181–213.
4. “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.
5. “ $p$ -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.
6. “On the image of complex conjugation in certain Galois representations”, joint with B.V. Le Hung, *Compositio Math.* 152 (2016), No. 7, 1476–1488.
7. “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.
8. “Local-global compatibility and monodromy for  $l = p$ ”, *Algebra & Number Theory* 8 (2014), no. 7, 1597–1646.
9. “Local-global compatibility and the action of monodromy on nearby cycles”, *Duke Mathematical Journal* 161 (2012), no. 12, 2311–2413.

10. “Multiplicative semigroups related to the  $3x + 1$  problem”, Adv. Appl. Math. 45 (2010), no. 3, 373-389.

GRANTS

- Royal Society Research Grants 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, (transferred in June 2017 to Chris Skinner due to my relocation to the UK) 2015–2017
- Funding for Banff Focused Research Group “Geometric aspects of  $p$ -adic automorphic forms” Fall 2014
- NSF Mathematical Sciences Postdoctoral Research Fellowship, \$150,000 2012–2015
- AIM SQuaRE Grant “The  $p$ -adic Langlands program for non-split groups” 2013-2015
- Funding for Banff Focused Research Group “The  $p$ -adic Langlands program for non-split groups” Summer 2012

SELECTED AWARDS  
AND HONORS

- Von Neumann Fellowship, IAS (declined in order to go on maternity leave) Spring 2018
- Mathematical Science Research Institute, Research Member Fall 2014
- 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

- Seminar on the Weil Conjectures, University of Bonn Summer 2017
- Étale cohomology, University of Bonn Winter 2016/2017
- Minicourse on Shimura varieties, Algebraic Geometry Bootcamp, Utah July 2015
- 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
- Teaching assistant for Frank Calegari and Toby Gee, Arizona Winter School Spring 2013
- Linear algebra and differential equations (Math 21b, 2 sections), Harvard University Spring 2012
- Multivariable calculus (Math 21a), Harvard University Fall 2008, 2009, 2010
- Course assistant to Marie-France Vigneras, Introduction to the  $p$ -adic Langlands program, Program for Women and Mathematics, Institute for Advanced Study May 2010
- Course assistant to Noam Elkies, Introduction to Analytic Number Theory (Math 229x), Harvard University Spring 2010
- Quadratic forms in number theory (tutorial), Harvard University Summer 2008
- Mathematics tutor, Frist Study Halls, Princeton University 2004-2006

## INVITED TALKS

- Séminaire de Géométrie Arithmétique Paris-Pékin-Tokyo, IHES January 2018
- UK-Japan Winter School 2018 on Number Theory (2 talks) January 2018
- Instruments of algebraic geometry, Bucharest, Romania September 2017
- Minicourse, Texel Island Summer School (4 talks) August 2017
- Max Planck Number Theory seminar July 2017
- Darmstadt Algebra seminar July 2017
- Journées Arithmétiques, Caen, France 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 Zurich 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
- Arizona Winter School, minicourse (4 talks) 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
- The Langlands correspondence in arithmetic and geometry, KIAS, minicourse (5 talks) 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
· Sophus Lie Days, Cornell (2 talks)	April 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

· MSRI/Evans lecture, Berkeley	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
· Workshos 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
RESEARCH VISITS	· École Normale Supérieure, Lyon	June 2015
	· MSRI, New Geometric Methods in Number Theory and Automorphic Forms	Aug.-Dec. 2014
	· Hausdorff Center for Mathematics, Bonn	June 2014
CONFERENCES ATTENDED	· Arithmetic geometry, representation theory and applications, Luminy	June 2015
	· $p$ -adic methods in number theory, Berkeley	May 2015
	· Categorical Structures in Harmonic Analysis, MSRI	November 2014
	· Introductory Workshop for New Geometric Methods in Number Theory and Automorphic Forms, MSRI	September 2014
	· Bellairs workshop in number theory, Barbados	May 2014
	· Women in Numbers 3, Banff International Research Station	April 2014
	· Gelfand Centennial Conference, MIT	September 2013
SERVICE	· Member of Chapman hiring committee at Imperial College London	2017-2018
	· Co-organized (with Toby Gee) a working seminar on Fargues's conjecture, Imperial College London	Fall 2017
	· Organized a reading course on Shimura varieties, University of Bonn	Summer 2017
	· AMS-Simons Travel Grant committee (Chair 2018-2019)	2017-2020
	· Co-organizer (with Frank Calegari and Richard Taylor), Special session on "Automorphic forms and arithmetic", Joint Math Meetings, Atlanta, GA	January 2017
	· Panel member for National Science Foundation review panel	2016-17
	· Member of the jury for the defense of Macarena Peche Irissarry, Université Pierre et Marie Curie	November 2016
	· Co-organizer (with Richard Taylor), Workshop on Emerging Topics: Torsion classes and modularity, IAS	November 2016
	· Co-organizer, Princeton/IAS number theory seminar	2013-2014, 2015-2016
	· Invited Speaker, European Girls' Math Olympiad, Busteni, Romania	April 2016
	· Invited Speaker, Women in Math and Statistics, Harvard	April 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, Banff Focused Research Group on "Geometric aspects of $p$ -adic automorphic forms"	November 2014
	· 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 Nogue'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 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
- TALKS IN WORKING SEMINARS
- The statement of Fargues's conjecture (2 talks), working seminar on Fargues's geometrization conjecture, Imperial College London Fall 2017
  - Sheaves on classifying stacks of  $p$ -adic groups, working seminar on Sheaves on the stack of vector bundles on the Fargues–Fontaine curve, University of Bonn Summer 2017
  - Descent, working seminar on The étale cohomology of diamonds, University of Bonn Winter 2016
  - Cohomological congruences between Heegner points, Princeton/IAS working seminar on Wei Zhang's work Spring 2016
  - Princeton/IAS working seminar on Emerton's "Local-global compatibility in the  $p$ -adic Langlands programme" Spring 2015
  - Background on  $p$ -divisible groups, Princeton/IAS working seminar on Scholze-Weinstein, 2 talks Spring 2014
  - Introduction to motives, Goncharov reading group, IAS Spring 2014
  - The anticanonical tower, Princeton/IAS working seminar on Scholze's "On torsion in the cohomology of locally symmetric varieties" Fall 2013
  - The motivic fundamental group, Princeton/IAS working seminar on Deligne's "The fundamental group of  $P^1$  minus three points" Fall 2011
- MISCELLANEOUS
- Citizenship: Romanian and American
  - Languages: Romanian (native), English (fluent), Spanish (fluent), German (beginner), French (reading)