Ana Caraiani

Academic career

2003 - 2007	B.A. in Mathematics, Summa cum Laudae, Princeton University, NJ, USA
2007 - 2012	PhD in Mathematics, Harvard University, Cambridge, MA, USA (advisor: Richard Taylor)
2012 - 2013	L.E. Dickson Instructor and NSF Postdoctoral Fellow, University of Chicago, IL, USA
2013 - 2016	Veblen Research Instructor and NSF Postdoctoral Fellow, Princeton University and Institute for Advanced Study, Princeton, NJ, USA
2014	Research Visit, Hausdorff Center for Mathematics, Bonn
2014	Research Visit, New Geometric Methods in Number Theory and Automorphic Forms, Mathematical Sciences Research Institute, Berkeley, CA, USA
2015	Research Visit, École Normale Superieure, Lyon, France
Since 2016	Bonn Junior Fellow, University of Bonn

Honours

2001	Silver Medal, International Mathematical Olympiad
2002, 2003	Gold Medal, International Mathematical Olympiad
2003, 2004	Putnam Fellow and Elizabeth Lowell Putnam Prize
2006	Andrew H. Brown Prize, Department of Mathematics, Princeton University, NJ, USA
2006	Member of 1st place Putnam team
2007	Alice T. Schafer Prize, Association for Women in Mathematics
2007	Middleton Miller Prize, Department of Mathematics, Princeton University, NJ, USA
2007	George B. Covington Prize, Department of Mathematics, Princeton University, NJ, USA
2007 - 2009	William Lowell Putnam Fellowship for Graduate Study, Harvard University, Cambridge, MA, USA
2007 - 2010	James Mills Peirce Fellowship for Graduate Study, Harvard University, Cambridge, MA, USA
2014	Research Member, Fall, Mathematical Science Research Institute, Berkeley, CA, USA

Invited Lectures

2014	MSRI-Evans lecture, Berkeley, CA, USA
2015	Sophus Lie Days, Cornell University, NY, USA
2017	Arizona Winter School, USA
2017	Journees Arithmetiques

Research profile

My research is at the interface of the Langlands correspondence with arithmetic algebraic geometry. At the heart of the Langlands program lies reciprocity, the conjectural correspondence between Galois representations and automorphic forms. Progress in the field has historically required the combined forces of many areas of mathematics and continues to do so. In my work,

I approach the correspondence from several different directions, combining number theoretic techniques, such as p-adic interpolation, with arithmetic geometry (perverse sheaves, p-adic Hodge theory), harmonic analysis (the trace formula) and representation theory (the theory of types). In joint work with Emerton, Gee, Geraghty, Paskunas and Shin, I constructed a candidate for the p-adic local Langlands correspondence for GL_n over a p-adic field and I showed that this construction recovers the p-adic local Langlands correspondence for $GL_2(Q_p)$; this led to proving some new cases of local-global compatibility. In joint work with Levin, I showed that the moduli space of Kisin modules with tame descent data is smoothly equivalent to a local model of a Shimura variety with parahoric level structure. In joint work with Scholze, I showed that the cohomology of compact unitary Shimura varieties is torsion-free and concentrated in the middle degree, when localized at a sufficiently generic system of Hecke eigenvalues.

My future research is focused on extending, in joint work with Scholze, the results about torsion in the cohomology of compact unitary Shimura varieties to the non-compact case. This presents significant difficulties and requires new ingredients, both from the point of view of arithmetic geometry (one needs to work with both minimal and toroidal compactifications of Shimura varieties) and from the point of view of the trace formula. I am also working on understanding consequences of such a result about non-compact Shimura varieties for the Galois representations corresponding to torsion classes in the cohomology of locally symmetric spaces. I am particularly interested in local-global compatibility at $l = p$ and applications to modularity or potential modularity of Galois representations. Furthermore, I am interested in discovering other consequences of the fact that Shimura varieties with infinite level at p are perfectoid and in studying moduli spaces of Galois representations via the moduli space of Kisin modules.

Selected publications

[1] Ana Caraiani and Bao V. Le Hung. On the image of complex conjugation in certain galois representations. *Compos. Math.*, 152(7):1476–1488, 2016.

[2] Ana Caraiani, Matthew Emerton, Toby Gee, David Geraghty, Vytautas Paskunas, and Sug Woo Shin. Patching and the p-adic local langlands correspondence. *Camb. J. Math.*, 4(2):197–287, 2016.

[3] Ana Caraiani. Monodromy and local-global compatibility for l=p. *Algebra Number Theory*, 8(7):1597–1646, 2014.

[4] Ana Caraiani. Local-global compatibility and the action of monodromy on nearby cycles. *Duke Math. J.*, 161(12):2311–2413, 2012.

[5] Ana Caraiani. Multiplicative semigroups related to the 3x+1 problem. *Adv. in Appl. Math.*, 45(3):373–389, 2010.