

# Peter Scholze



## Academic career

2010	Master, University of Bonn
2012	Dr. rer. nat., University of Bonn
Since 2012	Hausdorff Chair (W3), University of Bonn
Since 2018	Director, Max Planck Institute for Mathematics, Bonn

## Honours

2011	Clay Research Fellow
2012	Prix Peccot
2013	SASTRA Ramanujan Prize
2014	Clay Research Award
2015	Frank Nelson Cole Prize in Algebra from the American Mathematical Society
2015	Ostrowski Prize
2016	Prix Fermat
2016	Leibniz Prize
2016	EMS Prize
2016	Academy Prize of the Berlin-Brandenburg Academy of Sciences and Humanities
2017	Ordinary Member of the Academy of Science and Literature, Mainz
2017	Ordinary Member of the Berlin-Brandenburg Academy of Sciences and Humanities
2017	Member of the Leopoldina (German National Academy of Sciences)
2018	Fields Medal

## Invited Lectures

2012	Clay Research Conference, University of Oxford, England, UK
2012	Current Developments in Mathematics, Harvard University, Cambridge, MA, USA
2014	International Congress of Mathematicians, Seoul, South Korea
2014	Takagi Lectures, Tokyo, Japan
2015	Clay Research Conference, Oxford, UK
2015	Current Developments in Mathematics, Harvard University, Cambridge, MA, USA
2016	Plenary talk, European Congress of Mathematics, Berlin
2018	Plenary speaker, International Congress of Mathematicians, Rio de Janeiro, Brazil

## Research profile

My research is at the intersection of number theory and algebraic geometry, and deals with the basic questions and structures that underly our modern understanding of diophantine equations. This concerns on the one hand the Langlands program, which connects objects from arithmetic geometry, such as elliptic curves over number fields, with analytic or topological objects, such as modular forms or the cohomology of hyperbolic manifolds. On the other hand, this concerns the cohomological invariants attached to arithmetic varieties themselves, which forms the subject of Hodge theory, or more particularly  $p$ -adic Hodge theory.

My own contributions to these questions include the construction of Galois representations associated for example with torsion classes on hyperbolic 3-manifolds, and the development of a geometric framework underlying much of  $p$ -adic Hodge theory, in the form of perfectoid spaces. In the future, I plan to pursue these questions. In particular, building on perfectoid spaces, I want to transport some machinery from the geometric Langlands program to the case of  $p$ -adic

fields, and I hope to use this to obtain new results on the local Langlands conjecture for general groups over  $p$ -adic fields. On the other hand, in work with Bhatt and Morrow, we found new cohomological invariants of arithmetic varieties, which lead to a surprising  $q$ -deformation of de Rham cohomology, which I plan to study further.

### Editorships

- Journal of the AMS
- Compositio Math

**Research Area DE** I obtained new results on the geometry of moduli spaces of abelian varieties, by showing that they attain the structure of a perfectoid space after increasing the level at  $p$ . This was used to obtain new results on modular and automorphic forms, and in particular on the relation of  $p$ -adic automorphic forms with Galois representations,[4]. Recently, we were able to give more precise bounds on the cohomological degrees in which torsion can appear [2], leading to potential automorphy results for elliptic curves over CM fields.

### Selected publications

- [1] Bhargav Bhatt and Peter Scholze. Projectivity of the witt vector affine grassmannian. *Invent. Math.*, 209(2):329–423, 2017.
- [2] Ana Caraiani and Peter Scholze. On the generic part of the cohomology of compact unitary shimura varieties. *Ann. of Math. (2)*, 186(3):649–766, 2017.
- [3] Bhargav Bhatt and Peter Scholze. The pro- $\ell$ -etale topology for schemes. *Astérisque*, (369):99–201, 2015.
- [4] Peter Scholze. On torsion in the cohomology of locally symmetric varieties. *Ann. of Math. (2)*, 182(3):945–1066, 2015.
- [5] Peter Scholze. The local langlands correspondence for  $GL_n$  over  $p$ -adic fields. *Invent. Math.*, 192(3):663–715, 2013.
- [6] Peter Scholze.  $p$ -adic hodge theory for rigid-analytic varieties. *Forum Math. Pi*, 1:e1, 77, 2013.
- [7] Peter Scholze and Sug Woo Shin. On the cohomology of compact unitary group shimura varieties at ramified split places. *J. Amer. Math. Soc.*, 26(1):261–294, 2013.
- [8] Peter Scholze and Jared Weinstein. Moduli of  $p$ -divisible groups. *Camb. J. Math.*, 1(2):145–237, 2013.
- [9] Peter Scholze. Perfectoid spaces. *Publ. Math. Inst. Hautes Etudes Sci.*, 116:245–313, 2012.