

Office 666, Department of Mathematics  
180 Queen's Gate  
London SW7 2AZ, UK  
toby.gee@imperial.ac.uk  
wwwf.imperial.ac.uk/~tsg  
Date of birth: 2 January 1980  
Nationality: British

# Toby Gee

## Employment

- 2013– **Professor**, *Imperial College London*
- 2011–2013 **Senior Lecturer**, *Imperial College London*
- 2010–2011 **Assistant Professor**, *Northwestern University*
- 2008–2010 **Benjamin Peirce Lecturer**, *Harvard University*
- 2007–2008 **Postdoctoral Researcher**, *Northwestern University*
- 2004–2007 **EPSRC Postdoctoral Fellow**, *Imperial College London*

## Fellowships

- 2011–2013 **Sloan Fellowship**
- 2007–2010 **Miller Fellowship**, *University of California, Berkeley (declined)*
- 2004–2007 **Title A Fellow**, *Trinity College, Cambridge*

## University education

- 2001–2004 **PhD**, *Imperial College London*  
(advisor: Prof. Kevin Buzzard)
- 2000–2001 **Certificate of Advanced Study in Mathematics (Part III)**, *Trinity College, Cambridge*, with distinction
- 1997–2000 **BA in Mathematics**, *Trinity College, Cambridge*, First class in all three years  
Senior Wrangler (highest scoring student in the university)

## Grants

- 2020–2025 **ERC Advanced Grant (PI)**, €2,195,110
- 2016–2021 **Royal Society Wolfson Research Merit Award (PI)**, £50,000
- 2014–2019 **EPSRC Grant (joint with Kevin Buzzard)**, £620,441
- 2012–2017 **ERC Starting Grant (PI)**, €1,131,339
- 2012–2016 **Marie Curie Career Integration Grant (PI)**, €100,000
- 2011–2012 **NSF Standard Grant (PI) (modification of grant below)**, \$45,445
- 2011–2014 **NSF Standard Grant (PI) (declined due to return to UK)**, \$242,160
- 2011–2013 **Sloan Fellowship (PI) (declined due to return to UK)**, \$50,000
- 2008–2011 **NSF Standard Grant (PI)**, \$97,856

2004–2007 **EPSRC Postdoctoral Fellowship (PI)**, £105,602

### Awards, prizes and distinctions

- 2013 Fellow of the American Mathematical Society
- 2012 Leverhulme Prize
- 2012 Whitehead Prize (London Mathematical Society)

### Visiting positions

- 01/2013 Visiting Professor, Paris 13

### Doctoral students

- 2022– Siqi Yang (joint with Lassina Dembele and Fred Diamond)
- 2017–2021 Ashwin Iyengar (joint with James Newton)
- 2015–2019 Andrea Dotto
- 2011–2015 Jack Shotton
- 2011–2013 Christian Johansson (joint with Kevin Buzzard)

### Postdocs mentored

- 2022– Jeff Manning
- 2022– Yu Min
- 2021– Jack Sempliner
- 2020– Alice Pozzi
- 2016–2019 Carl Wang-Erickson
- 2015–2017 Yiwen Ding
- 2014–2016 James Newton
- 2014–2017 Olivier Taïbi
- 2013–2019 Rebecca Bellovin

### Conferences organised

- 2018 Scientific advisory board, special trimester on “Groupes algébriques et géométrisation du programme de Langlands”, ENS Lyon, France
- 2013 Summer Graduate Workshop on New Geometric Techniques in Number Theory, MSRI, Berkeley, USA
- 2013 Conference on Higher Rank Automorphic Forms and L-functions, Warwick, UK
- 2012 Conference on the  $p$ -adic Langlands program, Fields Institute, Toronto, Canada

### Editorships

- 2015– Editorial board, Selecta Math
- 2013–2018 Editorial board, Math. Annalen

2013 Editorial Advisor for the Bulletin, Journal and Proceedings of the London Mathematical Society

---

## Service

- 2014– Promotions committee (chair from 2019–), math department, Imperial College London
- 2013–2017 Research committee, math department, Imperial College London
- 2011– Organiser of number theory study groups and seminars, Imperial College London

---

## Selected talks

- 11/2022 Princeton/IAS Number Theory Seminar
- 10/2022 Conference on Arithmetic Algebraic Geometry, Darmstadt
- 09/2022  $p$ -adic Hodge Theory and Applications, Clay Workshop, Oxford
- 06/2022 Topology and Arithmetic around the Langlands Program, Stockholm
- 05/2022 Simons Symposium on  $p$ -adic Hodge Theory, Gleneagles
- 04/2022 Number theory seminar, University of Chicago
- 04/2021 Derived Galois Deformation Rings & Cohomology of Arithmetic Groups, Oberwolfach
- 01/2021 Automorphic forms, automorphic representations, Galois representations, Kyoto
- 09/2020 Serre weights conjectures and geometry of Shimura varieties, Montreal
- 07/2020 Local Langlands and  $p$ -adic methods, Bonn (cancelled)
- 03/2020 Interactions between group theory, number theory, combinatorics and geometry, Isaac Newton Institute, Cambridge (cancelled)
- 01/2020 International Colloquium on Arithmetic Geometry, Tata Institute, Mumbai
- 10/2019 Modularity and Moduli Spaces, Oaxaca, Mexico
- 10/2019 London–Paris seminar in memory of Jean-Marc Fontaine and Jean-Pierre Wintenberger, Paris
- 07/2019  $p$ -adic modular forms and Galois representations, Sheffield
- 06/2019 Opening Colloquium, Cluster of Excellence, University of Münster
- 03/2019 International conference on arithmetic geometry, Beijing
- 07/2018  $p$ -adic Langlands Correspondence, Shimura Varieties and Perfectoids, CIRM Luminy
- 07/2017 Plenary talk, Journées Arithmétiques, Caen
- 06/2016 Geometric Methods in the mod  $p$  local Langlands Correspondence, Pisa (2 lectures)
- 06/2015 Arithmetic geometry, representation theory and applications, CIRM, Luminy, France
- 11/2014 Colloquium, Queen Mary University
- 05/2014 The cohomology of arithmetic groups and the Langlands program, Barbados
- 04/2014 Morning Speaker, British Mathematical Colloquium, QMC London
- 01/2014 Simons Symposium on Families of Automorphic Forms and the Trace Formula, Puerto Rico
- 01/2013 Varieties de Shimura et Formes modulaires  $p$ -adiques, Paris

- 09/2012 Rational points on curves: a  $p$ -adic and computational perspective, University of Oxford
- 07/2012 Torsion in the homology of arithmetic groups, Banff
- 04/2012 The  $p$ -adic Langlands program: recent developments and applications, Fields Institute, Toronto
- 03/2012 Cohomology of Shimura varieties: arithmetic aspects and the construction of Galois representations, Fields Institute, Toronto
- 01/2012 Paris–Tokyo Number Theory Seminar, IHES, Paris
- 07/2011 Automorphic forms and Galois representations, LMS Durham Symposium, 2011 (2 lectures)
- 06/2011 Double Affine Hecke Algebras, the Langlands Program, and theoretical physics, CIRM, Luminy, France
- 06/2011 Conference on Explicit  $p$ -adic Hodge Theory, Lyon, France
- 04/2011 Colloquium, Columbia University
- 04/2011 Oliver Atkin Memorial Workshop, University of Illinois Chicago
- 03/2011 Galois Representations and Automorphic Forms, Institute for Advanced Study, Princeton
- 01/2010 Fontaine Trimester, IHP, Paris (3 lectures)
- 12/2009 Colloquium, Northwestern University
- 12/2009 Colloquium, Boston College
- 11/2009 Workshop on Arithmetic, Kanazawa, Japan
- 07/2009 Automorphic Representations, Geometry, and Arithmetic, Taipei, Taiwan
- 11/2008 Shimura Varieties, Automorphic Representations and Related Topics, Kyoto
- 08/2008 The stable trace formula, automorphic forms, and Galois representations, Banff
- 11/2006 Hot Topics: Modularity for  $GL(2)$  and Beyond, MSRI, Berkeley
- 11/2006 Joint London–Paris Number Theory seminar, Paris
- 07/2005 Galois representations, Strasbourg

## Summer schools

- 07/2022 Summer school on the Langlands Program, IHES, Paris
- 09/2019 Hausdorff School on the Emerton–Gee stack and related topics, Bonn (5 lectures)
- 06/2018 Algebraic Groups and Geometrization of the Langlands Program, Lyon (4 lectures)
- 01/2018 UK–Japan Winter School on Number Theory, King’s College London (2 lectures)
- 07/2013 MSRI Summer School, Berkeley (4 lectures)
- 03/2013 Arizona Winter School, Tucson (4 lectures)
- 01/2011 Winter school on Serre’s Conjecture, POSTECH, South Korea (4 lectures)

## Preprints

- 2022 A. Caraiani, M. Emerton, T. Gee, and D. Savitt. *Components of moduli stacks of two-dimensional Galois representations.*

A. Caraiani, M. Emerton, T. Gee, and D. Savitt. *The geometric Breuil-Mézard conjecture for two-dimensional potentially Barsotti-Tate Galois representations*.

A. Dotto, M. Emerton, and T. Gee. *Localization of smooth  $p$ -power torsion representations of  $GL_2(\mathbb{Q}_p)$* .

## Publications

- 2022 F. Calegari, M. Emerton, and T. Gee. “Globally realizable components of local deformation rings”. **Journal of the Institute of Mathematics of Jussieu. JIMJ. Journal de l’Institut de Mathématiques de Jussieu** 21.2, pp. 533–602.
- A. Caraiani, M. Emerton, T. Gee, and D. Savitt. “Local geometry of moduli stacks of two-dimensional Galois representations”. **Proceedings of the International Colloquium on ‘Arithmetic Geometry’, TIFR Mumbai, Jan. 6-10, 2020 (to appear)**.
- M. Emerton and T. Gee. “Moduli stacks of étale  $(\varphi, \Gamma)$ -modules and the existence of crystalline lifts”. **Annals of Math Studies (to appear December 2022)**.
- M. Emerton and T. Gee. “Moduli stacks of  $(\phi, \Gamma)$ -modules: a survey”. **Proceedings of the International Colloquium on ‘Arithmetic Geometry’, TIFR Mumbai, Jan. 6-10, 2020 (to appear)**.
- M. Emerton, T. Gee, and E. Hellmann. “An introduction to the categorical  $p$ -adic Langlands program”. **Proceedings of the 2022 IHES Summer School on the Langlands program (AMS, to appear)**.
- T. Gee. “Modularity Lifting Theorems”. **Essential Number Theory (to appear)**.
- T. Gee and J. Newton. “Patching and the completed homology of locally symmetric spaces”. **Journal of the Institute of Mathematics of Jussieu. JIMJ. Journal de l’Institut de Mathématiques de Jussieu** 21.2, pp. 395–458.
- 2021 G. Boxer, F. Calegari, T. Gee, and V. Pilloni. “Abelian surfaces over totally real fields are potentially modular”. **Publications Mathématiques. Institut de Hautes Études Scientifiques** 134, pp. 153–501.
- M. Emerton and T. Gee. “‘Scheme-theoretic images’ of morphisms of stacks”. **Algebraic Geometry** 8.1, pp. 1–132.
- 2019 R. Bellovin and T. Gee. “ $G$ -valued local deformation rings and global lifts”. **Algebra & Number Theory** 13.2, pp. 333–378.
- T. Gee and O. Taïbi. “Arthur’s multiplicity formula for  $\mathbf{GSp}_4$  and restriction to  $\mathbf{Sp}_4$ ”. en. **Journal de l’École polytechnique — Mathématiques** 6, pp. 469–535.
- 2018 T. Barnet-Lamb, T. Gee, and D. Geraghty. “Serre weights for  $U(n)$ ”. **Journal für die Reine und Angewandte Mathematik. [Crelle’s Journal]** 735, pp. 199–224.
- A. Caraiani, M. Emerton, T. Gee, D. Geraghty, V. Paškūnas, and S. W. Shin. “Patching and the  $p$ -adic Langlands program for  $GL_2(\mathbb{Q}_p)$ ”. **Compositio Mathematica** 154.3, pp. 503–548.
- T. Gee, F. Herzig, and D. Savitt. “General Serre weight conjectures”. **Journal of the European Mathematical Society (JEMS)** 20.12, pp. 2859–2949.

- 2017 F. Calegari, M. Emerton, T. Gee, and L. Mavrides. “Explicit Serre weights for two-dimensional Galois representations”. **Compositio Mathematica** 153.9, pp. 1893–1907.
- T. Gee, F. Herzig, T. Liu, and D. Savitt. “Potentially crystalline lifts of certain prescribed types”. **Documenta Mathematica** 22, pp. 397–422.
- 2016 K. Buzzard and T. Gee. “Slopes of modular forms”. **Families of automorphic forms and the trace formula**. Simons Symp. Springer, [Cham], pp. 93–109.
- A. Caraiani, M. Emerton, T. Gee, D. Geraghty, V. Paškūnas, and S. W. Shin. “Patching and the  $p$ -adic local Langlands correspondence”. **Cambridge Journal of Mathematics** 4.2, pp. 197–287.
- 2015 L. Dieulefait and T. Gee. “Automorphy lifting for small  $l$  (appendix to: Automorphy of  $Symm^5GL(2)$  and base change)”. **Journal de Mathématiques Pures et Appliquées. Neuvième Série** 104.4, pp. 619–656.
- M. Emerton and T. Gee. “ $p$ -adic Hodge-theoretic properties of étale cohomology with mod  $p$  coefficients, and the cohomology of Shimura varieties”. **Algebra & Number Theory** 9.5, pp. 1035–1088.
- M. Emerton, T. Gee, and D. Savitt. “Lattices in the cohomology of Shimura curves”. **Inventiones Mathematicae** 200.1, pp. 1–96.
- T. Gee and D. Geraghty. “The Breuil-Mézard conjecture for quaternion algebras”. **Université de Grenoble. Annales de l’Institut Fourier** 65.4, pp. 1557–1575.
- T. Gee, T. Liu, and D. Savitt. “The weight part of Serre’s conjecture for  $GL(2)$ ”. **Forum of Mathematics. Pi** 3, e2, 52.
- 2014 T. Barnet-Lamb, T. Gee, D. Geraghty, and R. Taylor. “Local-global compatibility for  $l = p$ , II”. **Annales Scientifiques de l’École Normale Supérieure. Quatrième Série** 47.1, pp. 165–179.
- T. Barnet-Lamb, T. Gee, D. Geraghty, and R. Taylor. “Potential automorphy and change of weight”. **Annals of Mathematics. Second Series** 179.2, pp. 501–609.
- K. Buzzard and T. Gee. “The conjectural connections between automorphic representations and Galois representations”. **Automorphic forms and Galois representations. Vol. 1**. Vol. 414. London Math. Soc. Lecture Note Ser. Cambridge Univ. Press, Cambridge, pp. 135–187.
- M. Emerton and T. Gee. “A geometric perspective on the Breuil-Mézard conjecture”. **Journal of the Institute of Mathematics of Jussieu. JIMJ. Journal de l’Institut de Mathématiques de Jussieu** 13.1, pp. 183–223.
- T. Gee and M. Kisin. “The Breuil-Mézard conjecture for potentially Barsotti-Tate representations”. **Forum of Mathematics. Pi** 2, e1, 56.
- T. Gee, T. Liu, and D. Savitt. “The Buzzard-Diamond-Jarvis conjecture for unitary groups”. **Journal of the American Mathematical Society** 27.2, pp. 389–435.
- 2013 T. Barnet-Lamb, T. Gee, and D. Geraghty. “Congruences between Hilbert modular forms: constructing ordinary lifts, II”. **Mathematical Research Letters** 20.1, pp. 67–72.

- T. Barnet-Lamb, T. Gee, and D. Geraghty. “Serre weights for rank two unitary groups”. **Mathematische Annalen** 356.4, pp. 1551–1598.
- K. Buzzard and T. Gee. “Explicit reduction modulo  $p$  of certain 2-dimensional crystalline representations, II”. **Bulletin of the London Mathematical Society** 45.4, pp. 779–788.
- F. Calegari and T. Gee. “Irreducibility of automorphic Galois representations of  $GL(n)$ ,  $n$  at most 5”. **Université de Grenoble. Annales de l’Institut Fourier** 63.5, pp. 1881–1912.
- M. Emerton, T. Gee, and F. Herzig. “Weight cycling and Serre-type conjectures for unitary groups”. **Duke Mathematical Journal** 162.9, pp. 1649–1722.
- T. Gee and P. Kassaei. “Companion forms in parallel weight one”. **Compositio Mathematica** 149.6, pp. 903–913.
- 2012 T. Barnet-Lamb, T. Gee, and D. Geraghty. “Congruences between Hilbert modular forms: constructing ordinary lifts”. **Duke Mathematical Journal** 161.8, pp. 1521–1580.
- T. Barnet-Lamb, T. Gee, D. Geraghty, and R. Taylor. “Local-global compatibility for  $l = p$ , I”. **Annales de la Faculté des Sciences de Toulouse. Mathématiques. Série 6** 21.1, pp. 57–92.
- T. Gee and D. Geraghty. “Companion forms for unitary and symplectic groups”. **Duke Mathematical Journal** 161.2, pp. 247–303.
- T. Gee, T. Liu, and D. Savitt. “Crystalline extensions and the weight part of Serre’s conjecture”. **Algebra & Number Theory** 6.7, pp. 1537–1559.
- 2011 T. Barnet-Lamb, T. Gee, and D. Geraghty. “The Sato-Tate conjecture for Hilbert modular forms”. **Journal of the American Mathematical Society** 24.2, pp. 411–469.
- T. Gee. “Automorphic lifts of prescribed types”. **Mathematische Annalen** 350.1, pp. 107–144.
- T. Gee. “On the weights of mod  $p$  Hilbert modular forms”. **Inventiones Mathematicae** 184.1, pp. 1–46.
- T. Gee and D. Savitt. “Serre weights for mod  $p$  Hilbert modular forms: the totally ramified case”. **Journal für die Reine und Angewandte Mathematik. [Crelle’s Journal]** 660, pp. 1–26.
- T. Gee and D. Savitt. “Serre weights for quaternion algebras”. **Compositio Mathematica** 147.4, pp. 1059–1086.
- 2009 K. Buzzard and T. Gee. “Explicit reduction modulo  $p$  of certain two-dimensional crystalline representations”. **International Mathematics Research Notices. IMRN** 12, pp. 2303–2317.
- T. Gee. “The Sato-Tate conjecture for modular forms of weight 3”. **Documenta Mathematica** 14, pp. 771–800.
- 2008 T. Gee. “Companion forms over totally real fields”. **Manuscripta Mathematica** 125.1, pp. 1–41.

- 2007 T. Gee. "Companion forms over totally real fields. II". **Duke Mathematical Journal** 136.2, pp. 275–284.
- 2006 T. Gee. "A modularity lifting theorem for weight two Hilbert modular forms". **Mathematical Research Letters** 13.5-6, pp. 805–811.
- P. B. Allen, F. Calegari, A. Caraiani, T. Gee, D. Helm, B. V. L. Hung, J. Newton, P. Scholze, R. Taylor, and J. A. Thorne. "Potential automorphy over CM fields". **Annals of Mathematics (to appear)**.