

CURRICULUM VITAE

Contact information

Name	Sophie Morel
Professional address	ENS de Lyon site Monod UMPA UMR 5669 CNRS 46, allée d'Italie 69364 Lyon Cedex 07, FRANCE
Telephone	+33 (0)4 72 72 84 45
E-mail	sophie.morel@ens-lyon.fr
Website	http://morel.perso.math.cnrs.fr/

Education

- Université Paris-Sud, PhD in mathematics, 2005.
- École Normale Supérieure, 1999-2003.

Diplomas

- 2001 : DEA "Méthodes algébriques" from Université Paris 6.
Title of the DEA thesis : Termes locaux dans la formule des points fixes de Lefschetz, d'après un article de M. Goresky et R. MacPherson.
Director : Gérard Laumon.
- 2003 : Agrégation externe de mathématiques (rank : 4th).
- December 2005 : PhD in mathematics, Université Paris-Sud.
Title : Complexes d'intersection des compactifications de Baily-Borel.
Le cas des groupes unitaires sur \mathbb{Q} .
Director : Gérard Laumon.

Academic positions

- Directeur de recherche, CNRS and ENS Lyon, since February 2020.
- Invited professor, Université Lyon 1, February-May 2018.
- Invited professor, ENS de Lyon, October 2017-January 2018.
- Professor, Princeton University, September 2012-January 2019.
- Member, Institute for Advanced Study, 2012-2013.
- Professor, Harvard University, December 2009- August 2012.
- Member, Institute for Advanced Study, 2010-2011.
- Visitor, Harvard University, September 2009 - December 2009.
- Member, Institute for Advanced Study, 2006-2009.

- Teaching assistant, Université Paris-Sud (September 2002-August 2005).

Publications

(available on my website and the arXiv)

- *Complexes d'intersection des compactifications de Baily-Borel. Le cas des groupes unitaires sur \mathbb{Q}* , thèse, Université Paris-Sud (2005)
- *Complexes pondérés sur les compactifications de Baily-Borel. Le cas des variétés de Siegel*, J. Amer. Math. Soc. 21 (2008), p 23-61
- *Note sur les polynômes de Kazhdan-Lusztig*, Math. Z. 268 (2011), no. 1-2, p 593-600
- *On the cohomology of certain non-compact Shimura varieties*, Annals of Mathematics Studies 173, Princeton University Press (2010)
- *Cohomologie d'intersection des variétés modulaires de Siegel, suite*, Compos. Math. 147 (2011), no. 6, p 1671-1740
- *The intersection complex as a weight truncation and an application to Shimura varieties*, Proceedings of the International Congress of Mathematicians, Hyderabad, India (2010)
- *The sign conjecture for Shimura varieties*, with Junecue Suh, Journal für die reine und angewandte Mathematik (2014)
- *Construction de représentations galoisiennes de torsion, d'après Peter Scholze*, séminaire Bourbaki, juin 2015
- *Some combinatorial identities appearing in the calculation of the cohomology of Siegel modular varieties*, with Richard Ehrenborg and Margaret Readdy, (*Algebraic Combinatorics*, October 2019)

Prepublications

(available on my website and the arXiv)

- *Mixed l -adic complexes for schemes over number fields* (submitted, 2019)
- *The six operations on perverse motives*, with Florian Ivorra (2019, submitted)
- *A generalization of combinatorial identities for stable discrete series constants*, with Richard Ehrenborg and Margaret Readdy (2020, submitted)
- *Sharing pizza in n dimensions*, with Richard Ehrenborg and Margaret Readdy (2021, submitted)
- *Pizza and 2-structures*, with Richard Ehrenborg and Margaret Readdy (2021, submitted)

Invited talks

- *Géométrie des variétés de Shimura associées à $\mathbf{GU}(n-1, 1)$ et calcul de termes locaux I et II*, talks at Bonn university in November-December 2004.
- *Complexes pondérés en caractéristique positive*, talk at the Université Paris 13 in January 2006.
- *Complexe d'intersection sur la compactification de Baily-Borel d'une variété modulaire de Siegel*, talk at the Institut de Recherche Mathématique Avancée in Strasbourg in January 2006.
- *Complexe d'intersection sur la compactification de Baily-Borel d'une variété modulaire de Siegel*, talk at the Université Paris 7 in February 2006.
- *Calculation of Kazhdan-Lusztig polynomials (a geometric interpretation of a formula of Brenti)*, talk at the University of Freiburg in June 2006.
- *Complexe d'intersection sur la compactification de Baily-Borel d'une variété modulaire de Siegel*, talk at the Institut de Recherche Mathématique de Rennes in July 2006.
- *Intersection complex on the Baily-Borel compactification of a Siegel modular variety*, talk at the Conference on Recent Developments in the Arithmetic of Shimura Varieties and Arakelov Geometry at the CRM in Barcelona in July 2006.
- *A formula for the intermediate extension of a pure perverse sheaf and its application to the calculation of Kazhdan-Lusztig polynomials*, talk in the Lie Groups and Representation Theory seminar at the University of Maryland in October 2006.
- *Intersection complex on the Baily-Borel compactification of a Siegel modular variety*, talk in the number theory seminar at Princeton University in November 2006.
- *Intersection complex on the Baily-Borel compactification of a Siegel modular variety*, talk in the “geometric Langlands” seminar at University of Chicago in January 2007.
- *Intersection complex on the Baily-Borel compactification of a Siegel modular variety*, talk at the Harvard-MIT number theory seminar in February 2007.
- *Intersection complex on the Baily-Borel compactification of a Siegel modular variety*, talk in the algebra seminar at University of Pennsylvania in March 2007.
- Talk at the Number Theory Days at EPF in Lausanne, in April 2007.
- *L-function of the intersection complex on certain unitary Shimura va-*

- rieties*, talk at the Japan-France conference on automorphic endoscopy at the CIRM in Luminy in June 2007.
- *Intersection cohomology of certain unitary Shimura varieties*, talk at the summer school on Serre’s modularity conjecture at the CIRM in Luminy in June 2007.
 - *L-function of the intersection complex on certain unitary Shimura varieties*, talk at the Conference on Automorphic Forms and Shimura Varieties, ICTP, Trieste, Italy, July 2007.
 - *On the cohomology of noncompact unitary Shimura varieties*, talk at the 10th Autumn Workshop on Number Theory, Hakuba, Japon, November 2007.
 - *On the cohomology of certain unitary Shimura varieties*, talk at the Columbia number theory seminar, April 2008.
 - Talk at the “Automorphic forms” session fo the Canada-France congress in Montréal, June 2008.
 - The Stable Trace Formula, Automorphic Forms and Galois Representations, summer school and conference at BIRS in Banff (two lectures in the summer school and one in the conference), August 2008.
 - *On the cohomology of some non-compact Shimura varieties*, two talks at the representation theory seminar of Northwestern University, November 2008.
 - *On the cohomology of certain noncompact Shimura varieties*, talk at the Harvard number theory seminar, November 2008.
 - A colloquium talk (*The cohomology of Shimura varieties and the Langlands program*) and a talk in the number theory seminar (*On the cohomology of some non-compact Shimura varieties*) at the University of Toronto, December 2008.
 - *On the cohomology of some non-compact Shimura varieties*, talk in the “Algebra, Combinatorics and Geometry” seminar of the University of Pittsburgh, February 2009.
 - *On the cohomology of some non-compact Shimura varieties*, talk at the number theory seminar of Columbia University, March 2009.
 - *On the cohomology of some non-compact Shimura varieties*, talk at the Journées de Géométrie Arithmétique in Rennes, July 2009.
 - Colloquium talk in the “Program for Women and Mathematics” on the p -adic Langlands progral at the Institute for Advanced Study in Princeton, New Jersey, May 2010.
 - *Combinatorial problems arising in the application of the trace formula to Shimura varieties*, talk at the “Workshop on arithmetic geometry and related topics” in Taipei, Taiwan, July 2010.
 - *The intersection complex as a weight truncation and an application to*

- Shimura varieties*, talk in the number theory section of the ICM in Hyderabad (India), August 2010.
- *Intersection cohomology is useless*, Workshop on Galois Representations and Automorphic Forms at the Institute for Advanced Study in Princeton, March 2011.
 - Talk at the MIT number theory seminar in November 2011.
 - *Some applications of almost mathematics*, colloquium talk at Princeton University in December 2011.
 - *Mixed ℓ -adic complexes on varieties over \mathbb{Q}* , International Colloquium on Automorphic Representations and L-Functions at the Tata Institute of Fundamental Research in Mumbai, January 2012.
 - *How to work with perverse sheaves and Mixed ℓ -adic complexes on varieties over \mathbb{Q}* , Program on Automorphic Forms : Arithmetic and Geometry, at the Erwin Schrödinger Institute in Vienna, January 2012.
 - *Cohomology of non-compact Shimura varieties*, Workshop on the Cohomology of Shimura Varieties at the Fields Institute in Toronto, March 2012.
 - *The cohomology of Shimura varieties at unramified places*, Fields Medal Symposium at the Fields Institute in Toronto, October 2012.
 - Talk at the Johns Hopkins-University of Maryland Algebra and Number Theory Day', May 2013.
 - *Conjecture des signes pour les variétés de Shimura (avec J. Suh)*, Séminaire d'arithmétique et de géométrie algébrique in Orsay, May 2013.
 - INdAM day in Palermo, Sicily, June 2013.
 - Colloquium at McGill University on the Kontsevich period conjecture in March 2015.
 - *Pseudo-representations for general groups*, talk at the Erwin Schrödinger Institute in Vienna, May 2015.
 - *Construction de représentations galoisiennes de torsion, d'après Peter Scholze*, séminaire Bourbaki, June 2015.
 - Décembre 2016 : two talks at the workshop *Global Langlands correspondence* at AIM in Palo Alto.
 - *Global Langlands parameters*, deux colloquium talks at TIFR in Mumbai and IISER in Pune, January 2017.
 - *Geometric Satake correspondence*, talk at the graduate student seminar in TIFR in Mumbai, January 2017.
 - *Derived deformation rings*, talk at the Einstein Institute of Mathematics of Hebrew University in Jerusalem, February 2017.
 - *Cohomology of moduli stacks of shtuka*, talk at the conference *p -adic aspects of automorphic forms* at the IMP in Teheran.

- *Cohomology of moduli stacks of shtuka*, Québec-Vermont number theory seminar, May 2017.
- *Tannakian formalism and reciprocity laws*, colloquium talk at McGill University in May 2017.
- *An unexpected application of the Langlands program*, talk at Tabriz University in January 2018.
- *The Artin conjecture*, the 10th Iranian Group theory conference, Teheran, January 2018.
- *The standard sign conjecture for Shimura varieties*, talk at FRIAS in Freiburg, February 2018.
- *De la cohomologie des variétés de Shimura À la théorie de Morse discrète*, colloquium talk at the institut Camille Jordan, Lyon, February 2018.
- *The Grothendieck six operations on derived categories of mixed perverse sheaves*, conference in honor of the 75th birthday of Pierre Schapira, Paris, April 2018.
- *Extension of vector bundles and vanishing of local cohomology*, New developments in automorphic forms, Sevilla, April 2018.
- *The six functor formalism for Nori motives*, conference of the special trimester “Groupes algébriques et géométrisation du programme de Langlands”, Lyon, May 2018.
- *Automorphic forms and Shimura varieties*, Sixth Abel Conference : A Mathematical Celebration of Robert P. Langlands, Minneapolis, November 2018.
- *Une preuve géométrique d’une identité de caractères de séries discrètes (travail en commun avec Richard Ehrenborg et Margaret Readdy)*, talk at the number theory seminar of the ENS Lyon, January 2019.
- *Relative Nori motives (joint with F. Ivorra)*, talk in Stony Brook’s algebraic geometry seminar, March 2019.
- *Combinatorial proof of a character identity (joint with R. Ehrenborg and M. Readdy)*, talks in the BC-MIT number theory seminar in May 2019 and in the University of Kentucky’s discrete CATS seminar in October 2019.

Advanced courses

- Spring 2014 : graduate course at Princeton University on the geometric Satake correspondence.
- Fall 2014 : graduate course at Princeton University on Vincent Laforgue’s work on the global Langlands correspondence.
- February-March 2015 : mini-course (10h) called *On the Kontsevich-*

Zagier conjecture on periods at the CRM in Montréal as Aisenstadt chair.

- May 2015 : mini-course (10h) called *Deformation rings in equal characteristic* at the CRM in Montréal as Aisenstadt chair.
- February 2016 : mini-course (10h) at the IPM in Teheran on the global Langlands correspondence.
- May 2016 : mini-course (8h) at the ENS de Lyon on the geometric Langlands correspondence.
- June 2016 : mini-course (4h) at the summer school *Fundamental groups in arithmetic geometry* on Vincent Lafforgue's work.
- January 2017 : mini-course (10h) on derived deformation rings at TIFR in Mumbai.
- January-April 2018 : graduate course at the Université Lyon 1 on derived algebraic geometry.
- May 2018 : mini-course (10h) with Benoît Stroh on the work of Genestier-Lafforgue about the local Langlands correspondence.
- Spring 2019 : graduate course at Princeton University on rigid analytic geometry (adic spaces).
- Fall 2019 : graduate course at Princeton University on homological algebra.
- Fall 2020 : graduate algebraic geometry course at the ENS Lyon.

Other teaching

- At Harvard University :
 - Fall 2009 : Math 21b (linear algebra and differential equations).
 - Spring 2010 : Math 129 (number fields).
 - Fall 2011 : Math 21b (linear algebra and differential equations), and a graduate student seminar on Mordell's theory of pure Hodge modules (with Sam Raskin).
 - Spring 2012 : Math 21a (multivariable calculus).
- At Princeton University :
 - Fall 2012 : Co-organizer (with Chris Skinner and Richard Taylor) of the working seminar on number theory.
 - Spring 2013 : Co-organizer (with Chris Skinner and Richard Taylor) of the working seminar on number theory.
 - Fall 2013 : Math 449 (Representation theory of compact Lie groups) and Co-organizer (with Chris Skinner, Richard Taylor and Shouwu Zhang) of the working seminar on number theory.
 - Spring 2014 : Co-organizer (with Chris Skinner, Richard Taylor and Shouwu Zhang) of the working seminar on number theory.

- Fall 2014 : Math 449 (Representation theory of Lie algebras), and Co-organizer (with Chris Skinner, Richard Taylor and Shouwu Zhang) of the working seminar on number theory.
- Fall 2016 : Math 449 (Representation theory : finite groups, compact groups and introduction to Lie groups and Lie algebras) and Co-organizer (with Chris Skinner, Richard Taylor and Shouwu Zhang) of the working seminar on number theory.
- Spring 2017 : Math 217 (Honors linear algebra) and Co-organizer (with Chris Skinner, Richard Taylor and Shouwu Zhang) of the working seminar on number theory.
- I participated (and gave lectures) in the working seminars on reductive group schemes at the Université Lyon 1 and on Fargues's geometric proof of local class field theory at the ENS de Lyon.
- Undergraduate seminar at the ENS de Lyon in January-April 2018 (about representations of finite groups and applications to random walks).
- Fall 2018 : Math 449 (Representation theory : representations of locally compact groups, Peter-Weyl theorem, Gelfand pairs, applications).
- Spring 2020 : Undergraduate algebraic geometry at the ENS Lyon.
- At the ENS Lyon :
- Spring 2020 : Classical algebraic geometry.

Course notes and exposition

(available on my website)

- *Representation theory (fall 2018)*
- *Introduction à la géométrie algébrique dérivée* (notes of my graduate class at the Université Lyon 1 in January-April 2018.
- Notes of my two graduate classes about geometric Satake and Vincent Lafforgue's work (taken by Dan Collins, not proofread by me).
- *Notes from MAT 449 (Introduction to representation theory, Fall 2016)* (notes of all the lectures, homework problems, take-home final and full solutions)
- *I know that you know : enigmas based on the concept of common knowledge* (expository, in Persian, joint with Mohammad Shahryari; appeared in the Newsletter of the Iranian Mathematical Society, 149-150, Fall-Winter 2017)
- *Beilinson's construction of nearby cycles and gluing*
- *A quick introduction to perverse sheaves*

Service

- Participation in Hiring committees at Harvard and Princeton Universities (at the graduate school, postdoc and senior faculty level).
- Member of the editorial committee of the *Journal de l'École polytechnique* and of *Annales Scientifiques de l'École Normale Supérieure*.
- Member of the outside scientific committee of the special trimester “Groupes algébriques et géométrisation du programme de Langlands” (ENS de Lyon and Université Lyon 1, April-June 2018).
- Organizer (with Dennis Gaitsgory and Xinwen Zhu) of the workshop “Global Langlands correspondence” at AIM in December 2016.
- Organizer (with Peter Scholze, Richard Taylor and Jared Weinstein) of the workshop *Perfectoid Spaces and their Applications* at MSRI in February 2014.
- Organizer (with Pascal Boyer, Alain Genestier, Laurent Lafforgue, Sergey Lysenko and Bao Chau Ngo) of the conference *De la géométrie algébrique aux formes automorphes : une conférence en l'honneur de Gérard Laumon* (Orsay, June 2012) and editor of the proceedings of that conference.
- Referee for the ERC.
- Since 2007 : Referee for *Annales Scientifiques de l'École Normale Supérieure*, *Annals of Mathematics*, *Astérisque*, *Compositio Mathematica*, *Duke Mathematical Journal*, *Inventiones Mathematicae*, *Journal de l'Institut Mathématique de Jussieu*, *Journal für die reine und angewandte Mathematik (Crelle)*, *Journal of the American Mathematical Society*.

Graduate advising

- Kathleen Emerson (phd, 2013-2018), topic : *Comparison of different definitions of pseudo-characters*.
- Josselin Poiret, Spring 2021, master's thesis.
- Swann Tubach, Spring 2021, master's thesis.

Undergraduate advising

- Spring 2012 : Lucia Mocz, reading course on the étale fundamental group.
- Spring 2013 : Minh-Tam Trinh, junior project titled *From representation theory to L-functions*.

- Spring 2015 : Daniel Li, sophomore independent project titled *Deligne-Lusztig theory for $GL_n(\mathbb{F}_q)$* .
- Fall 2016-Spring 2017 : Daniel Li, senior thesis titled *A Scholzian approach to the local Langlands correspondence for GL_n over function fields*.
- Spring 2017 : Joshua Wang, reading course on modern algebraic geometry.
- Spring 2017 : Roger van Peski, junior project titled *Macdonald polynomials and root systems*.
- Spring 2017 : Timothy Ratigan, junior project titled *Local class field theory is easier*.
- Spring 2017 : Xiaoyu Xu, junior project titled *A homological approach to Hilbert's third problem*.
- Spring 2019 : Two reading courses (introduction to Lie groups and modern algebraic geometry).
- Spring 2019 : Eitan Levin, junior project on invariant theory.
- Spring 2020 : Riku Kurama, junior project on de Jong's conjecture.
- Spring 2021 : Antoine Galet, senior thesis.

Fellowships and honors

- Clay Research Fellowship, 2006-2011.
- Speaker in the number theory section of the ICM in Hyderabad (India), August 2010.
- Prize of the European Mathematical Society (July 2012).
- Inaugural AWM-Microsoft prize in algebraic and number theory (August 2014).
- Aisenstadt chair at the CRM in Montréal (Spring 2015).