Simon Pepin Lehalleur

Curriculum Vitae

PERSONAL INFORMATION

Nationality: French

Date of birth : 9th of January 1986

Personal situation: Married, three children

Professional address:
Korteweg-de Vries Institute for Mathematics, University of Amsterdam
Science Park 105-107, 3rd floor
1098 XG Amsterdam
The Netherlands

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RESEARCH

Interests (Algebraic and arithmetic geometry, homotopy theory, machine learning):

- Motivic homotopy theory, motivic sheaves, six-operations formalism
- Motives of moduli spaces: vector bundles, Higgs bundles
- $\mathbb{A}^1$-enumerative geometry and Grothendieck-Witt Euler characteristics
- Exponential motives and exponential periods
- Singular learning theory in Bayesian statistics and applications to phase transitions in machine learning.

Research positions

Postdoctoral researcher 01/2023-
(research group of Prof. Lenny Taelman, Universiteit van Amsterdam)

Postdoctoral researcher 01/2020-12/2022
(research group of Prof. Ben Moonen, Radboud University Nijmegen)

Principal Investigator SPP 1786 (Wissenschaflicher Mitarbeiter) 04/2019- 12/2019
(research group of Prof. Hélène Esnault, Freie Universität Berlin)

Postdoc (Wissenschaftlicher Mitarbeiter) 04/2018- 04/2019
(research group of Prof. Hélène Esnault, Freie Universität Berlin)

Einstein fellowship postdoctoral position 04/2016- 04/2018
(research group of Prof. Hélène Esnault, Freie Universität Berlin)

Ph.D. with Prof. Joseph Ayoub (Universität Zürich), defended 6/11/2015 09/ 2011-11/2015
Title: "An abelian category of relative 1-motives"

2 years as a Ph.D. student in Paris 13 under the supervision of Prof. Jörg Wildeshaus 09/2009-09/2011

Publications

Euler characteristics of homogeneous and weighted-homogeneous hypersurfaces (with M. Levine and V. Srinivas), arXiv 2101.00482, accepted for publication in *Advances in Mathematics*

Voevodsky motives of stacks of coherent sheaves on a curve (with V. Hoskins), arXiv 2208.03204, accepted for publication in the *Annales de l'Institut Fourier*.

Motives of moduli spaces of bundles on curves via variation of stability and flips (with L. Fu and V. Hoskins), arXiv 2011.14872, accepted for publication in the *Journal of the London Mathematical Society*.

Motives of moduli spaces of rank 3 vector bundles and Higgs bundles on a curve (with L. Fu and V. Hoskins), *Electronic Research Archive* 30 (2022), no. 1, 66–89

On the Voevodsky motive of the moduli space of Higgs bundles on a curve (with V. Hoskins), *Selecta Math.* (N.S.) 27 (2021), no. 1, Paper No. 11

A formula for the Voevodsky motive of the moduli stack of vector bundles on a curve (with V. Hoskins), *Geometry & Topology* 25 (2021), no. 7, 3555–3589

On the Voevodsky motive of the moduli stack of vector bundles on a curve (with V. Hoskins), *The Quarterly Journal of Mathematics* 72 (2021), no. 1-2, 71–114.

Constructible 1-motives and exactness of realisation functors, *Documenta Mathematica* 24, 1721-1737, 2019

Triangulated categories of relative 1-motives, *Advances in Mathematics*, vol. 347, 473-596, 2019

On the relative motive of a commutative group scheme (with G. Ancona and A. Huber), *Algebraic geometry*, vol. 3 issue 2, 2016

Subgroups of maximal rank of reductive groups, in "Autour des schémas en groupes", *Panoramas et Synthèses* 47, 2015

Preprints

Motivic mirror symmetry for Higgs bundles (with V. Hoskins), arXiv 2205.15393

Exponentiation of coefficient systems and exponential motives (with M. Gallauer), arXiv 2211.17247

Invited research visits

Semester "New equivariant methods in algebraic and differential geometry", Isaac Newton Institute, Cambridge 01-06/2024

Tokyo Institute of Technology, Tokyo 09/2018

Mittag-Leffler Institute, Stockholm 01/2017

Tata Institute, Mumbai 10/2016

Lecture series/minicourses

Motives of moduli of bundles on curves, Indian Institute of Technology Madras (online) 11/2021

Triangulated categories of motivic sheaves, University of Freiburg 02/2020

Conference talks

Main theorems of singular learning theory, "Machine learning, singularities and phase transitions" 09/2023

Regular and singular statistical models, "Machine learning, singularities and phase transitions" 09/2023

Quadratic Euler characteristics of singular and non-commutative varieties, GQT Colloquium, Nijmegen 08/2023

Introductory talk - motives and moduli, Motives and moduli in representation theory, Nijmegen 07/2023

Quadratic conductor formulas and Hodge theory of hypersurfaces, Conference in honor of V. Srinivas's 65th Birthday, TIFR, Mumbai. 01/2023

Motivic mirror symmetry for Higgs bundles, Harnessing motivic invariants, Essen 06/2022

Motivic mirror symmetry for Higgs bundles, Motives and Hodge theory, Mittag-Leffler Institute, Stockholm (online) 10/2021

A motivic non-abelian Hodge theorem, Higgs bundles and relative topics (online) 05/2020

On the motive of the moduli space of Higgs bundles, SPP Jahrestagung, Essen 10/2019

A formula for the motive of the moduli stack of vector bundles, GLEN, Manchester 03/2019

Generic Foliated cohomology, Motives, Foliations and the Conservativity conjecture, Berlin 09/2018

E-localisation, Motives, Foliations and the Conservativity conjecture, Berlin 09/2018

E-localisation, Conservativity conjecture workshop, Harumura 09/2018

The Voevodsky motive of the moduli stack of vector bundles, NoGAGS Berlin 11/2017

Reductive group schemes, Workshop on equivariant and motivic homotopy, Osnabrück 10/2017

The motivic t-structure for relative 1*-motives*, Annual Meeting of the SPP 1786 03/2017

The motivic t-structure for relative 1*-motives*, Generalizations of $\mathbb{A}^1$-Homotopy Invariance in Algebraic Geometry and Homotopy Theory, Usedom 04/2016

An introduction to motivic homotopy theory, Motivic Homotopy theory day, FU Berlin 03/2016

The Borel-De Siebenthal theorem, SGA3 summer school, Luminy 09/2011

Seminar talks

Motives of moduli of bundles on curves, IPM, Tehran (online) 02/2024

Motives of moduli of bundles on curves, Darmstadt (online) 01/2023

Motivic mirror symmetry for Higgs bundles, Padova (online) 12/2022

Motivic mirror symmetry for Higgs bundles, Academia Sinica, Taiwan (online) 07/2022

Motivic mirror symmetry for Higgs bundles, Topology seminar, Wuppertal (online) 01/2022

Quadratic enumerative geometry and the Deligne-Milnor formula, Quadratic forms, linear algebraic groups and beyond (online) 10/2020

Exponential periods and Exponential motives, GADEPs, IMPA (Rio) (online) 05/2021

Motives of moduli spaces of bundles on curves, Jussieu (Paris) (online) 10/2020

Motives of moduli spaces of bundles on curves, Purdue (online) 10/2020

Constructible 1-motives, Amsterdam 02/2020

A formula for the Voevodsky motive of the moduli stack of vector bundles, Berlin 10/2018

A formula for the Voevodsky motive of the moduli stack of vector bundles over a curve, Tokyo Institute of Technology 09/2018

Triangulated categories of relative 1-motives, University of Illinois Urbana Champaign 03/2018

The Voevodsky motive of the moduli stack of vector bundles, University of Illinois Chicago 03/2018

Constructible 1-motives, KTH Stockholm 02/2018

On the motive of the stack of vector bundles on a curve, University of Oxford 02/2018

The Voevodsky motive of the moduli stack of vector bundles, FU Berlin 02/2017

The motivic t-structure for relative 1*-motives*, Rennes 11/2016

Relative 1*-motives*, Tata Institute Mumbai 10/2016

Triangulated categories of 1-motivic sheaves, Singapore 08/2016

The motivic t-structure for relative 1*-motives*, Regensburg 01/2016

The motivic t-structure for relative 1*-motives*, Freiburg (Oberseminar) 10/2015

Deligne 1-motives in the triangulated categories of mixed motives, Paris Réga 12/2012

RESEARCH GRANTS

Van Gogh scholarship (travel grant for Dutch-French collaboration), 2240 EUR 2021

SPP 1786, Project "Exponential motivic homotopy theory, foliations and applications", Principal investigator, 213 600 EUR 2018-2020

Forschungskredit: Candoc, Principal investigator, University of Zürich, 55200 CHF 2013-2014

TEACHING

Teaching activities

Radboud Universiteit/University of Amsterdam (2020-)

Lecturer Mastermath course "Infinity-categories" WS23

Lecturer "Linear Algebra" (Amsterdam University College) SS23

Lecturer Mastermath course "Commutative Algebra" WS21

Lecturer Graduate course "Categories and Infinity-categories" (University of Amsterdam) WS20

Freie Universität Berlin (2016-2019)

Student seminar "Categories and infinity-categories" WS18

Teaching assistant for "Local Class Field Theory" WS18

Student seminar "Differential Galois Theory" SS18

Teaching assistant for "Complex Analysis" SS18

Lecturer Graduate course "Models of curves and abelian varieties" SS17

University of Zürich (2011-2015): teaching assistant

Linear Algebra I-II (Bachelor course, in German) WS14-SS15

Programming in Python (Bachelor course) WS13

Differential forms in topology (Masters course) SS13

Algebraic Geometry (Masters course) WS12

Probability and statistics for science students (Bachelor course, in German) SS12

Linear Algebra and Geometry for teaching students (Bachelor course, in German) WS 11

Université Paris XIII: (2009-2011): teaching assistant

Mathematics for Computer science (Bachelor course for computer science students, in French) SS11

Linear Algebra (Bachelor course, in French) WS10

Master thesis supervision

Matrix factorisations and Bott periodicity, T. Arnstein (University of Amsterdam) exp. 2024

Relative Galois theory of ∞-topoi and the relative Étale homotopy type, L. Martini (FU Berlin) 2019

Galois representations attached to modular forms of weight 2, D. Loutchko (FU Berlin) 2019

Model categories and unstable $\mathbb{A}^1$-homotopy category, V. Tabakov (FU Berlin) 2019

Bachelor thesis supervision

Representations of compact groups and the Peter-Weyl theorem, R. Gisolf (University of Amsterdam) 2020

The Étale fundamental group and the regular inverse Galois problem, L. Martini (FU Berlin) 2018

EDUCATION

Master in mathematics with distinction in University Paris 7 Denis Diderot 09/2008

"Agrégation de Mathématiques" 09/2007

Bacherlor in mathematics with distinction, University Paris 11 Orsay 09/2006

Entered the Ecole Normale Supérieure (Paris) 09/2005

ORGANISATION AND SERVICE

Conference organisation

Workshop "Machine learning, singularities and phase transitions" (University of Amsterdam) 18/09/23-21/09/23

Conference "Motives in moduli and representation theory" (Radboud University Nijmegen) 10/07/23-14/07/23

Conference "Homotopy theory, K-theory, and trace methods" (Radboud University Nijmegen) 5/07/23-7/07/23

Workshop "Motivic and non-commutative aspects of enumerative geometry" (Radboud University Nijmegen) 3/07/23-5/07/23

Arbeitsgemeinschaft "Motives, Foliations and the Conservativity Conjecture" (Humboldt University) 24/09/18-28/09/18

Summer school "Motives for periods" (FU Berlin) 28/08/2017-1/09/2017

Research seminar organisation

Organised seminar on "Hilbert schemes of points on surfaces" (Radboud/University of Amsterdam) Spring 2020

Supervised seminar on "Motivic Galois groups and periods" (FU Berlin) 2016

Co-organised the Graduate Colloquium of the Graduate School of Mathematics of Zürich 2013-2014

PhD defense committees

Peter Badea (Radboud, Nijmegen) 09.12.2020

Eva Martinez (FU Berlin) 29.06.2018

Irem Portakal (FU Berlin) 27.04.2018

Matej Filip (FU Berlin) 09.03.2018

Committees

Advisory board of the Mathematics department, Radboud University 2020-2022

Hiring committees for several postdocs in the research group of Prof. Esnault 2016-2019

Referee work

Refereed for Advances in Mathematics, Annales scientifiques de l'ENS, Tohoku mathematical journal, Mémoires de la Société Mathématique de France., Kodai Mathematical Journal, Journal of Pure and Applied Algebra, Bulletin of the London Mathematical Society.

Zentrallblatt and Mathreviews

Reviewed 8 papers for Zentralblatt and Mathreviews.

LANGUAGES

French : native

English : written, spoken (fluent)

Spanish : written, spoken (B2)

German : written, spoken (B1)

Dutch : written, spoken (A2)