Samuel Lelièvre

Mathematician at Université Paris-Saclay, Orsay, France

Positions held

2006–prés. *Maître de conférences* (Assistant professor), Université Paris-Saclay, Orsay, France

2005–2006 *Post-doctorate Research Fellow*, University of Warwick, England

2004–2005 *Jeune post-doc de l'École polytechnique* (Post-doctorate Research Fellow of École polytechnique), jointly at two places: Institut de mathématiques de Luminy (IML, Marseille, France) and Institut de mathématiques et de modélisation de Montpellier (I3M, Montpellier, France)

2003–2004 *Research and teaching assistant* at Université Montpellier 2, Montpellier, France

2000–2003 *Doctoral fellow of École polytechnique* at Université de Rennes 1, Rennes, France (PhD student with teaching duties, at Rennes, funded by École polytechnique)

Diplomas

2004 Doctorat de mathématiques (PhD in Mathematics). Université Rennes 1, Rennes, France. Advisor: Anton Zorich. Thesis: *Arithmetic Veech surfaces in genus two: Teichmüller discs, Veech groups, Siegel–Veech constants.*

2000 Diplôme d'études approfondies (masters) in "Fundamental mathematics and applications" specialising in algebra and geometry. Université Rennes 1, Rennes, France. Advisor: Anton Zorich.

1999 Ingénieur de l'École polytechnique. École polytechnique, Palaiseau, France.
(Engineering diploma of École polytechnique.)

Awards, distinctions, grants, invited visits

Delegation at CNRS

Academics in French universities can apply to "Delegation at CNRS", a research grant with teaching release, whereby CNRS buys off their teaching from their home university and welcomes them for a semester as a full-time researcher, either in their home lab or in a different CNRS unit.

2017–2018 Six-month Delegation at CNRS, research grant with teaching release, in Morelia, Mexico

2012–2013 Six-month Delegation at CNRS, research grant with teaching release, in Orsay, France

2010–2011 Six-month Delegation at CNRS, research grant with teaching release, in Orsay, France

Scientific distinction award

Academics in French universities can apply to the "Prime d'encadrement doctoral et de recherche" (briefly renamed "Prime d'excellence scientifique" around 2010), a bonus recognizing doctoral training and/or excellent research, awarded for four-year periods.

2018–2022 Prime d'encadrement doctoral et de recherche

2014–2018 Prime d'encadrement doctoral et de recherche

2010–2014 Prime d'excellence scientifique

Grants

The Agence Nationale de la Recherche (ANR) is a French institution that funds scientific research projects. It funds scientific teams, typically over four years.

Horizon 2020 is the European Union's eighth framework programme funding research, technological development, and innovation, providing grants through open and competitive calls, running from 2014 to 2020.

I have been part of the following ANR or Horizon 2020 projects.

2015–2019 OpenDreamKit (Horizon 2020 European Research Infrastructure Project #676541).
Theme: databases, knowledge management, and software for mathematics.

2011–2015 ANR Geodym: Geometry and dynamics of moduli spaces

2007–2011 ANR Modunombres: Number theory and modular forms

2006–2010 ANR Teichmüller: Dynamics in Teichmüller space

Invited visits

The indicated duration (in days, weeks or months) is the duration of my visit.

2019-12	1 w	*Holomorphic differentials in mathematics and physics*, MSRI, Berkeley, CA, USA
2019-09	2 m	*Illustrating Mathematics*, ICERM, Providence, RI, USA
2018-09	1 w	*Flat Surfaces and Algebraic Curves*, Oberwolfach, Allemagne
2017-10	10 d	Research visit to Jayadev Athreya, U Washington, Seattle, USA
2017-09	6 m	Semester at LaSoL, Franco-Mexican joint lab of CNRS and UNAM, in Morelia, Mexico
2017-07	4 w	*Research cluster on polygonal billiards*, Tufts, Boston, USA
2016-04	1 w	*Flat surfaces and dynamics of moduli space*, BIRS-CMO, Oaxaca, Mexico
2014-07	6 w	*Research cluster on random groups*, Tufts, Boston, USA
2014-03	1 w	*Flat Surfaces and Dynamics on Moduli Space*, Oberwolfach, Allemagne
2012-04	2 w	visited Jayadev Athreya at Urbana-Champaign and Moon Duchin at Tufts, Boston, USA
2011-12	1 w	*Flows on surfaces, symbolic dynamics and dynamics in moduli spaces*, Moscow, Russia
2011-05	1 w	*Billiards, Flat Surfaces, and Dynamics on Moduli Spaces*, Oberwolfach, Germany
2010	4 w	Geometry and Dynamics of Teichmüller Spaces, Hausdorff Institute for Mathematics, Bonn, Germany

Research activities

Conference organisation

2020-10	3 d	*Global virtual Sage days*, online
2020-02	5 d	*Software tools for mathematics and illustration*, Orsay, France
2018-09	5 d	*Software tools for mathematics*, Koper, Slovenia
2018-01	5 d	*Software tools for mathematics*, Morelia, Mexico

Research project supervision

2020	Felipe Arbulú: M2 AAG Orsay: Master thesis on "Tiling billiards", defended 25 Aug 2020
2016	Rodolfo Gutierrez: M2 AAG Orsay: Master thesis on "Diffusion rate for generalised wind-tree billiards", defended 24 Jun 2016, co-advised with Anton Zorich
2015	Lucie Barbier, M1 Orsay: research project on "Classification of periodic tilings of the plane".
2015	Sophie Bellot, M1 Orsay: research project on "Undecidability and tilings".
2011	Zhenlong Fan, M1 Orsay: research project on "Continued fractions and the modular surface".
2007	Andy Hayden, 4th year at Warwick: MMath research project on "Closed orbits and lattice stabilisers for the action of $\mathrm{SL}(2, \mathbf{R})$ on translation surfaces".
2006	David Zmiaikou, final year at École polytechnique: research project on "Group actions on origamis".

Recent talks at seminars or short meetings

2020-10	Séminaire Ernest, Aix-Marseille U, Marseille, France
2020-03	Geometry and topology seminar, U Toulouse, Toulouse, France
2019-11	Dynamics and probability seminar, Tufts U, Boston area, USA
2019-10	Brown geometry/topology seminar
2019-06	Meeting on flat surfaces, U Bordeaux, Bordeaux, France
2018-12	Séminaire de théorie ergodique, Jussieu, Paris, France
2018-10	Séminaire plat, Paris, France
2017-10	Mexico City / Morelia / Oaxaca meeting in dynamics, Oaxaca, Mexico
2017-06	Algebra and number theory seminar, Saarbrücken, Germany
2016-10	Séminaire de géométrie et topologie, U Paul Sabatier, Toulouse, France
2016-03	Journée autour de la soutenance de thèse de Vincent Alberge, Strasbourg, France
2015-12	*Workshop on Teichmüller theory*, RIMS, Kyoto, Japan
2015-11	Séminaire Teich, Aix-Marseille U, Marseille, France
2015-10	Séminaire de mathématiques, U Blaise Pascal, Clermont-Ferrand, France

Publications

I published 13 articles in peer-reviewed journals, 2 articles in peer-reviewed conference proceedings, and one appendix to an article by other authors in a peer-reviewed journal.

Here is the list of my co-authors and of my publications.

Co-authors

JA	Jayadev S Athreya	MI	Mihnea Iancu	LM	Luca Marchese	AS	A P Sánchez
JC	Jonathan Chaika	KJ	Kasia Jankewicz	TM	Thierry Monteil	RS	Robert Silhol
DD	Diana Davis	SC	Shelby C Kilmer	CM	Christopher Mooney	NM	Nicolas M Thiéry
POD	Paul-Olivier Dehaye	MK	Michael Kohlhase	DM	Dennis Müller	ST	Serge Troubetzkoy
VD	Vincent Delecroix	AK	Alexander Konovalov	MP	Markus Pfeiffer	CU	Corinna Ulcigrai
MD	Moon Duchin	SL	Samuel Lelièvre	FR	Florian Rabe	BW	Barak Weiss
PH	Pascal Hubert	JM	John Mackay	ER	Emmanuel Royer	TW	Tom Wiesing

Published papers

PH, SL, LM, CU. The Lagrange spectrum for some square-tiled surfaces. *Israel J Math* **225**:2 (2018), 553–607.

POD, MI, MK, AK, SL, DM, MP, FR, NT, TW. Interoperability in the OpenDreamKit project: the math-in-the-middle approach. Int'l Conference on Intelligent Computer Mathematics, 117–131. Springer, 2016.

MD, KJ, SK, SL, JM, AS. A sharper threshold for random groups at density one-half. *Groups Geom. Dyn.* 10 (2016), 985–1005. `doi:10.4171/GGD/374`

SL, TM, BW. Everything is illuminated. *Geom. Topol.* 20:3 (2016), 1737–1762.

SL, BW. Translation surfaces with no convex presentation. *Geom. Funct. Anal.* 25:6 (2015), 1902–1936.

JA, JC, SL. The gap distribution of slopes on the golden L. In *Recent trends in ergodic theory and dynamical systems*, 47–62. Contemp. Math. 631, Amer. Math. Soc., Providence, RI, 2015.

VD, PH, SL. Diffusion for the periodic wind-tree model. *Ann. Sc. ÉNS* (4) 47:6 (2014), 1085–1110.

MD, SL, CM. The sprawl conjecture for convex bodies. *Experimental mathematics*, 2013.

MD, SL, CM. The geometry of spheres in free abelian groups. *Geometriae Dedicata*, 2012.

MD, SL, CM. Statistical hyperbolicity in groups. *Alg. & Geom. Topology* 12 (2012) 1–18.

PH, SL, ST. The Ehrenfest wind-tree model: periodic directions, recurrence, diffusion. *Crelle*, 2011.

SL, ER. Orbitwise countings in $\mathcal{H}(2)$ and quasimodular forms. *IMRN* 2006, Art. id 42151, 30 pp.

SL. Siegel–Veech constants in $\mathcal{H}(2)$. *Geometry and Topology* 10 (2006), 1157–1172.

PH, SL. Prime arithmetic Teichmüller discs in $\mathcal{H}(2)$. *Isr. J. Math.* 151 (2006), 281–321.

PH, SL. Noncongruence subgroups in $\mathcal{H}(2)$. IMRN 2005:1 (2005), 47–64.

Appendix to a paper by other authors

SL. Completely periodic configurations in $\mathcal{H}(4)$. Appeared as Appendix C (pages 419–422) for the paper:

> Carlos Matheus, Martin Möller, Jean-Christophe Yoccoz.
> A criterion for the simplicity of the Lyapunov spectrum of square-tiled surfaces.
> *Inventiones mathematicae* **202**:1 (2015), 333–425. `doi:10.1007/s00222-014-0565-5`

Book participation

I am a contributor for two entries (2 pages each) in the book:
Diana Davis (editor). *Illustrating Mathematics*. American Mathematical Society, 2020.

Preprint

DD, SL. Periodic paths on the pentagon, double pentagon and golden L. `arXiv:1810.11310`
SL, RS. Multi-geodesic tessellations, fractional Dehn twists and uniformization of algebraic curves. `arXiv:math/0702374`

In progress

With Alba Marina Málaga Sabogal and Pierre Arnoux, we are writing a paper on polyhedral flat tori.

Teaching

I have been teaching university classes since Fall 2000, with occasional research-only semesters, be it via a semester-long or year-long research position, or by teaching a year's worth in a single semester.

The type of teaching included lectures, problem classes, computer-based problem classes.

The levels taught at covered 1st to 5th year of university studies, where the French 5th year, also known as the second year of Master, corresponds to the beginning of graduate studies in the USA.

I taught at four different universities: Université Rennes 1 (France), Université Montpellier 2 (France), University of Warwick (England), Université Paris-Saclay (Orsay, France).

Subjects taught: calculus, analysis, differential equations, Fourier series, algebra, linear algebra, Euclidean geometry (mainly 2D and 3D), hyperbolic geometry, dynamical systems, computer algebra, numerical analysis.

In recent years I have been teaching more and more **computer-assisted mathematics** courses, in years 1 to 5 of university studies at Orsay. For example in 2018–2019 I taught the following computer labs with Sage and/or Python:
- (year 1) Programming projects in mathematics and computer science
- (year 2) Python for scientific computation
- (year 3) Effective algebra (mostly finite fields, with Sage)
- (year 4) Algebra and computer algebra (factoring polynomials and integers, with Sage)

In 2020–2021 I teach "Curves and surfaces" in year 2 using Sage at Orsay.

In Jan 2020 and Jan 2021 I was invited lecturer in the "Mathematical software" course in the Master in Mathematics at University of Granada, Spain.

Free software for mathematics and science

SageMath SageMath, or Sage, is a generalist free software system for mathematics, that uses many pre-existing libraries and software systems. I contribute to its development and promote it. I offer short presentations of Sage for research, and help people installing and getting started. I answer questions on the Ask Sage website (ask.sagemath.org) for which I am an administrator. I was an organiser or helper at many Sage Days.

OpenDreamKit I participated in the OpenDreamKit project (`https://opendreamkit.org/`), European project n° 676541 (Horizon 2020, European Research Infrastructure), started 2015-09 for 4 years, for which my involvement was 10% of my time. This project gathered around 100 participants across 20 sites in Europe.

Software Carpentry I also joined the «Software Carpentry» movement, which aims to teach researchers computer skills to become more efficientin their work by learning automation, versioning, and programming. I was a helper at a Software Carpentry workshop in the Paris area in Mar 2016, then organised one in Orsay in May 2016, then one in Morelia, Mexico in Jan 2018, then one in Koper, Slovenia in Sep 2018. I trained as a Software Carpentry instructor in Feb 2018 and got certified.

Free software for mathematics: events attended

2020-10	Sage Days 110, online
2020-05	Sage Days 109, online
2019-08	Mathematical databases, Cernay-la-Ville, France
2019-07	School *Algebraic geometry, number theory, cryptography, robot kinematics*, Limbe, Cameroon
2019-06	Developer days, Cernay-la-Ville, France
2019-01	Lean together, Amsterdam, Netherlands
2018-09	Software tools for mathematics, Koper, Slovenia
2018-08	JupyterCon, New York, New York, USA
2018-07	International conference on mathematical software, Notre Dame U, USA
2018-07	Sage Days 94, Zaragoza, Spain
2018-06	School *Teichmüller dynamics & mapping class groups*, Grenoble, France
2018-02	Software tools for mathematics, Morelia, Mexico
2017-12	Computation in geometric topology, Warwick, UK
2016-08	Sage Days 75, Inria Saclay, France
2016-06	OpenDreamKit meeting, Brême, Allemagne
2016-06	Sage Days 74, Meudon, France
2016-05	Sage Days 77, Cernay-la-ville, France
2016-01	OpenDreamKit meeting, Saint-Andrews, Écosse
2015-11	OpenDreamKit meeting, Edinburgh, Écosse
2015-09	OpenDreamKit kick-off meeting, Orsay, France

Diffusion / outreach in primary and secondary education and to the greater public

I am very involved in the communication / diffusion / outreach of mathematics, in particular by helping run the French chapter of the IMAGINARY project from 2014 to 2019.

I am also a member of the CNRS's AuDiMath network (AuDiMath stands for "autour de la diffusion des mathématiques": around the diffusion of mathematics).

Events   I organised and/or animated the following events.

2020-03-05 → 07	IMAGINARY booth, Salon Les maths dans tous leurs états, Toulouse
2019-05-23 → 26	IMAGINARY booth, Salon Culture et jeux mathématiques, Paris
2019-03-16	IMAGINARY booth, Salon Les maths dans tous leurs états, Toulouse
2019-01-31 → 02-01	IMAGINARY booth, Mathematics village, Saint-Germain-Lembron, France
2019-01 → 2019-03	"Ludomath" exhibition, Drancy, Paris area, France
2017-06-16 → 17	IMAGINARY booth, Mathematics village, Clermont-Ferrand, France
2017-05-27 → 30	IMAGINARY booth, Salon Culture et jeux mathématiques, Paris
2016-05-26 → 29	IMAGINARY booth, Salon Culture et jeux mathématiques, Paris
2016-05-21	exhibition for special day on "math and imagery", IHP, Paris
2015-10-22	exhibition for 25th anniversary of the European math society, IHP, Paris, France
2015-05-28 → 31	IMAGINARY booth, Salon Culture et jeux mathématiques, Paris
2015-02-10	"Fractals: du compliqué avec du simple" ("Fractals: complex from simple"), Salon Bouge la science, Bourg-la-Reine, Paris area, France
2014-03	Activities in 10 high school classes, and round table with teachers and staff, for the "Week of mathematics". Collège Anne Frank, Saint-Dizier, France

Funding   I obtained and/or managed some funding for diffusion of mathematics projects.

2018	4500 €	Fondation Blaise Pascal: "Ludomath" exhibition
2017-06	3000 €	FMJH "Votre région fait des maths": diffusion activities at Labo math Orsay
2017-01	4500 €	La Diagonale Paris-Saclay: Illumination et blocage
2015	5000 €	La Diagonale Paris-Saclay: IMAGINARY France
2015	7000 €	Cap'Maths: IMAGINARY France

Meetings   I participated in the following meetings on diffusion of mathematics.

2018-04-09 → 13	Journées MaDiNa. Université de Nantes, Nantes, France
2017-06-29 → 30	Journées AuDiMath. Université d'Orléans, Orléans, France
2017-04-21	Journée diffusion des mathématiques dans le Sud de l'Île-de-France. École polytechnique, Palaiseau, France.

Research internships for undergraduates and high-school students   From Feb to May 2021 I am mentoring two pairs of 3rd-year students in the Math department at Orsay. One pair is working on Akiyama's "Minimum polyhedron on n vertices" preprint, the other one on Cusick and Flahive's book *The Lagrange and Markov spectra*.

In late June 2019 I co-mentored the 2-week internship of two high school students in the Math department at Orsay. They worked on the rattleback: modelling one with algebraic equations, using GeoGebra, SURFER, Sage, and finally exporting to STL format and slicing for 3d printing.

From mid-May to mid-June 2019 I mentored the 4-week internship of two second-year students in the Mathematics department at Orsay. One of them worked on Akiyama's "Minimum polyhedron on n vertices" preprint, the other one on Cusick and Flahive's book *The Lagrange and Markov spectra*.