Rodolphe RICHARD

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Informations
Born the 3rd of June, ***1984***
French *citizen,*
UK ***Settled*** *status*

Mathematician

Work experience

Since 2024	***Post-doctorant***,	*University of Manchester*, United Kingdom.
2023 - 2024	***Invited researcher***,	*IHÉS*, France.
2019 - 2023	***Leverhulme grant***,	*Univ. College London*, United Kingdom.
2016 - 2017	*Research and Teaching in Mathematics.*	
2018 - 2019	***Post-doctorant***,	*University of Cambridge*, United Kingdom.
	Research and Teaching in Mathematics.	
2014 - 2016	***Post-doctorant***,	*Universiteit Leiden*, Netherland.
	Research and Teaching in Mathematics.	
2013 - 2014	***Collaborator in Robotics***,	*ÉPFL, Lausanne*, Switzerland.
	Software development inside Clinical robotics team: C++/Qt/SoQt, C#.	
2009 - 2013	***Post-doctorant***,	*ÉPFL, Lausanne and ETH, Zürich*, Switzerland.
	Research and Teaching in Mathematics.	
2006 - 2009	***PhD student "moniteur normalien"***,	*Université Rennes 1*, France.
	Research and Teaching in Mathematics.	
2002 - 2006	***Student employee "fonctionnaire stagiaire"***,	*ÉNS Paris*, France.

Education and Degrees

2014	*Swiss* ***teaching degree****; taught in Gymnase d'Yverdon.*	
2009	***PhD*** *in mathematics, with Pr A. Chambert-Loir*	*Université Rennes 1*
	Dynamics and Arithmetic Geometry	
2004 - 2005	*Predoctoral year:* ***Long stay in India***,	*TIFR, Mumbaï; CMI Chennaï*
	Research stay at TIFR and Teaching at CMI	
2004	***DÉA/Master*** *Algèbre et Géométrie*	*Université Rennes 1*
	ranked 1st, ***aged 19****, with a mean grade* ***over 18,5/20***	
2004	***Agrégation in mathematics.*** *(french higher teaching diploma)*	
2003	***BSc*** *and "Maîtrise" (****MSc 1st year****) in mathematics*	*Éns Paris*
	Validated all courses for ***BSc in physics*** *the same year.*	
2002	***École normale supérieure de Paris****, entered 2nd, the youngest.*	
2000 - 2002	*French "Baccalauréat", preparatory school, University "DEUG" in mathematics*	
2000	***Awards*** *at "concours général de mathématiques 2000"(French olympiade)*	

Teaching Experience

Teaching degrees *Agrégation de Mathématiques,* *France – 2004*
Haute école pédagogique de Lausanne, *Switzerland – 2014*

Roles held *Assistant teacher; Chief assistant; Supervisor; Head teacher.*

Levels *PhD — MSc (1st, 2nd years) — BSc (1st, 2nd, 3rd years) — Highschool*

Audience *Students in mathematics, mixed scientists, engineering, architecture; Highschool.*

2005	*Calculus*	*Chennaï Math. Inst. (BSc)*
2006–2009	*Affine Geometry*	*Univ. Rennes 1 (MSc)*
	Euclidean Geometry	*Univ. Rennes 1 (MSc)*
	General mathematics for non-mathematicians	*Univ. Rennes 1 (BSc)*
	Supervision	*Univ. Rennes 1 (BSc and MSc)*
2009–2012	*Berkovich spaces and Modular curves*	*ÉPFL (PhD course)*
	Number Theory	*ÉPFL (MSc)*
	Functional analysis	*ÉPFL (MSc)*
	Descriptive geometry	*, ÉPFL (BSc Architecture))*
	Calculus	*ÉPFL (BSc Architecture)*
	Linear Algebra	*ÉPFL (BSc Engineering)*
2013–2014	*Highschool Mathematics*	*Yverdon Highschool, Switzerland*
2014–2016	*Galois theory*	*Univ. Leiden (BSc)*
	Representation theory	*Univ. Leiden (MSc)*
2018–2019	*Probability and Measure*	*Cambridge (BSc)*
2019–2023	*Lie groups and Lie Algebras*	*Univ. Coll. London (MSc)*
	Number Theory	*Univ. Coll. London (BSc)*

Remote Teaching *Experience in remote teaching: remote exams, remote lectures.*

Languages

French	***Native speaker***	*C2*
English	***Fluent**, Living in the UK for 6 years*	*C2*
Italian	***Conversational***	*A2 - B1*

took courses several semesters at ÉPFL; numerous stays in Italy.

Computer experience

Operating systems ***GNU/Linux** since Ubuntu 7.04, **Windows** since 95b, **Android**, **OS X** (Mac), **Real-time extension** for Windows (Ardence/Zero interval).*

Development ***C++**/Qt/SoQt:Object oriented, Graphic interface, Virtual reality.*
Software designed for rehabilitation of hemiplegic children, in in shape of a virtual reality game interacting with a robotic device inside Real-time extension of windows environment.

Computer algebra ***SAGE**, **Maple**, **Mathematica**, **MAGMA**,**PariGP**, **Scilab***

- *Maple: **implemented** algorithm on formal solving of differential equations, 2002*
- *SAGE: **devised** and **implemented** algorithm on p-adic differential equations, 2013*
- *Magma/SAGE: **devised** and **demonstrated** algorithm in Number fields, 2021*

Document systems ***LaTeX**: thesis report, research articles, this document (with some GIMP). Knowledge in (X)HTML/CSS/PHP/SQL.*

Some of my Research interests

Geometry, Number Theory, Algebra and Dynamics

Homogeneous dynamics

Application of rigidity of unipotent dynamics (Ratners theorem) to dynamical problems in lattices spaces.
`Keywords:` ***Ratner theorems, homogeneous spaces, Bruhat-Tits buildings, algebraic groups, real and p-adic Lie groups***

Arithmetic geometry

Applying the above to dynamics of Galois action in Shimura varieties, with application to problem of André-Pink type and point counting. Studying variants of Zilber-pink conjectures: modulo p, over $\mathbf{Z}$, equidistribution.
`Keywords:` ***Shimura varieties, Zilber-Pink, Unlikely intersections, equidistribution, André-Oort, André-Pink-Zannier, Manin-Mumford, Abelian varieties, o-minimality.***

p-adic differential equations

An explicit algebraic approach to Pulita's theory, and application to effective explicit algorithms and to p-adic theory of exponential sums.
`Keywords:` ***p-adic differential equations, p-adic cohomology, exponential sums.***

Berkovich space of the modular curve

Studying analogue dynamics of Galois action in the modular curve in the associated p-adic analytic space.
`Keywords:` ***Berkovich spaces, p-adic equidistribution, p-adic periods***.

Arithmetic stability

How the Arakelov-arithmetic form of Mumford stability can be used as a uniform approach to dynamical and arithmetic aspects of lattices spaces.
`Keywords:` ***Geometric invariant theory, Symmetric spaces, Euclidean lattices.***

Main Publications

(submitted) 2024 ***Heights on 'Hybrid orbits' in Shimura varieties*** *(with A. Yafaev), Submitted (2024) to the* ***Proceedings of the LMS****.*

2025 ***Generalised André-Pink-Zannier Conjecture for Shimura varieties of abelian type*** *(with A. Yafaev).*
Publications Mathématiques de l'IHÉS (2025)*, Vol. 141 pp. 249331,*
https://doi.org/10.1007/s10240-025-00154-4

2024 ***Height functions on Hecke orbits and the generalised André-Pink-Zannier conjecture*** *(with A. Yafaev),*
Composition Mathematica *(2024), Volume 160(11):2531-2584.*
https://doi:10.1112/S0010437X2400722X
https://arxiv.org/abs/2109.13718

2024 ***Équidistribution de sous-variétés spéciales et o-minimalité: André-Oort géométrique*** *(with E. Ullmo, app. with J. Chen),*
Annales de l'Institut Fourier (2024) *Volume 74 no. 6.*
https://aif.centre-mersenne.org/articles/10.5802/aif.3644/

(subm.) 2009–17 ***Homogeneous dynamics and Unlikely intersections***

Publications

(submitted) 2024 *Heights on 'Hybrid orbits' in Shimura varieties.* *(with A. Yafaev), Submitted (2024) to the* ***Proceedings of the LMS****,*
https://arxiv.org/abs/2406.20013

(To Appear) *A common generalisation of the André-Oort and André-Pink-Zannier conjectures.* *(with A. Yafaev), To Appear,* ***LMS Lecture Notes Series.***
https://arxiv.org/abs/2401.03528

(submitted) 2021 *Manin-Mumford in arithmetic pencils .* *(with G. Baldi and E. Ullmo), Final stage of review at* ***Crelle's Journal***
https://arxiv.org/abs/2105.12027

2025 *Generalised André-Pink-Zannier Conjecture for Shimura varieties of abelian type*
(with A. Yafaev), ***C. R. Acad. Sci. Paris.****, Vol. 363 (2025), p. 873-878*
https://doi.org/10.5802/crmath.751

2025 *Generalised André-Pink-Zannier Conjecture for Shimura varieties of abelian type* *(with A. Yafaev).*
Publications Mathématiques de l'IHÉS (141)*, pp. 249331 (2025),*
https://doi.org/10.1007/s10240-025-00154-4

2024 *Height functions on Hecke orbits and the generalised André-Pink-Zannier conjecture .* *(with A. Yafaev),*
Composition Mathematica *(2024), 160(11):2531-2584.*
https://doi:10.1112/S0010437X2400722X
https://arxiv.org/abs/2109.13718

2024 *Équidistribution de sous-variétés spéciales et o-minimalité: André-Oort géométrique* *(with E. Ullmo, with an appendix with Jiaming Chen),*
Annales de l'Institut Fourier *Volume 74 (2024) no. 6, pp. 2667-2721.*
https://aif.centre-mersenne.org/articles/10.5802/aif.3644/

2023 *On The Generalised André-Pink-Zannier Conjecture* *(with A. Yafaev),*
C. R. Acad. Sci. Paris *Vol. 361 (2023), pp. 1717-1722*
https://doi.org/10.5802/crmath.491

2023 *Problèmes de type André-Oort en pinceau arithmétique*,
Expositiones Mathematicae *Vol. 41(3), Sept. 2023,*
https://doi.org/10.1016/j.exmath.2023.05.004

2023 *A two dimensional arithmetic André-Oort problem*,
Bull. of the London Mathematical Society *Vol. 55(3), June 2023,*
https://doi.org/10.1112/blms.12804,
https://arxiv.org/abs/1808.07900
https://mathscinet.ams.org/article?mr=4618237

2023 *Manin-Mumford topologique fort*
Annales de La Faculté des Sciences de Toulouse (To appear)
https://afst.centre-mersenne.org/page/coming-issues/.

2022 *Manin-Mumford par le critère de Weyl.*
Journal of Number Theory, *Vol. 239, Oct. 2022,*
https://doi.org/10.1016/j.jnt.2021.11.007,
https://mathscinet.ams.org/article?mr=4434490

2021 *Constructing abelian extensions with prescribed norms.*
(with C. Frei),
Mathematics of Computation, July 22, 2021 (2021)
https://doi.org/10.1090/mcom/3663
https://arxiv.org/abs/2006.08968
https://mathscinet.ams.org/article?mr=4350543

2020 *A mod p variant of the André–Oort conjecture (j/w B. Edixhoven),*
Rend. Circ. Mat. Palermo, II. Ser (2018).
https://www.doi.org/10.1007/s12215-018-00392-y
https://arxiv.org/abs/1807.03607
https://mathscinet.ams.org/article?mr=4148780

2019 *Stabilité analytique et Convergence locale de translatées en dynamique homogène S-arithmétique.*
(with T. Zamojski),
C. R. Acad. Sci. Paris, Ser. I, 357 (2019)
https://doi.org/10.1016/j.crma.2019.02.005

2019 *Topological and equidistributional refinement of the André-Pink-Zannier conjecture at finitely many places.*
(w. A. Yafaev),
C. R. Acad. Sci. Paris, Ser. I, (2019)
https://doi.org/10.1016/j.crma.2019.01.013

2018 *Répartition Galoisienne Ultramétrique d'une classe d'isogenie de courbes elliptiques: Le cas de la mauvaise reduction. Application aux hauteurs locales*,
J. Th. Nombres Bordeaux 30 (2018), no. 1, 118.
https://www.jstor.org/stable/26274045
http://www.ams.org/mathscinet-getitem?mr=3809706

2017 *Geometric results on linear actions of reductive Lie groups for applications to homogeneous dynamics*,
(joint work with Nimish Shah),
Ergodic Theory and Dynamical Systems 38 (2018), no. 7,
https://doi.org/10.1017/etds.2016.138
https://arxiv.org/abs/1305.6557
http://www.ams.org/mathscinet-getitem?mr=3846726

2016 *On π-exponentials II : Closed formula for the index*,
J. Th. Nombres Bordeaux, vol. 28 no. 2 (2016),
https://www.jstor.org/stable/26274045
https://arxiv.org/abs/1403.0615
http://www.ams.org/mathscinet-getitem?mr=3509723

2015 *Des π-exponentielles I: vecteurs de Witt annulés par Frobenius et algorithme de (leur) rayon de convergence*
Rendiconti del Seminario Matematico della Univ. di Padova 133.
https://doi.org/10.4171/RSMUP/133-7
https://arxiv.org/abs/1403.0610
http://www.ams.org/mathscinet-getitem?mr=3354948

2013–2014 ..... *Gap year in clinical robotics*

2009–2017 *Homogeneous dynamics and Unlikely intersections*
https://arxiv.org/abs/1809.03802
A collection of ***four articles*** *– 189 pages.*

- **2017** *Inner Galois Equidistribution and S-Hecke orbits (58 p.)* *(j/w A. Yafaev)*
- **2016** *Limit distribution of Translated pieces of possibly irrational leaves in S-arithmetic homogeneous spaces (84 p.)* *(j/w T. Zamojski)*
- **2009** *Résultat géométrique sur les représentations de groupe réductifs sur un corps ultramétrique* *(from PhD)*
- **2009** *On narrowness for translated algebraic probabilities in S-arithmetic homogeneous spaces* *(from PhD)*

  The above four articles have been submitted together as a 189 pp. book. Its ***first and only submission is from 2017****. The editors and several reviewers encountered difficulties, and the* ***much delayed reviewing process is still ongoing****.*

2013 *Répartition galoisienne d'une classe disogénie de courbes elliptiques*
Int. J. Number Theory, 09, (2013), pp.517-543
https://doi.org/10.1142/S1793042112501199
http://www.ams.org/mathscinet-getitem?mr=3005563

2009 *Répartition galoisienne d'une classe disogénie de courbes elliptiques [Hyperbolic Galois distribution of an isogeny class of elliptic curves]*,
C. R. Acad. Sci. Paris, Ser. I 347 (2009)
https://doi.org/10.1016/j.crma.2008.12.008
http://www.ams.org/mathscinet-getitem?mr=2538097

PhD Thesis

Nov. 2009 *Sur quelques questions d'équidistribution en géométrie arithmétique.*
PhD thesis available in Open access at:
https://tel.archives-ouvertes.fr/tel-00438515/
Comprising six articles

- *Répartition galoisienne d'une classe disogénie de courbes elliptiques [Hyperbolic Galois distribution of an isogeny class of elliptic curves]*, ***Published in C. R. Acad. Sci. Paris, Ser. I 347 (2009)****.*
- *Répartition galoisienne d'une classe disogénie de courbes elliptiques*
  Published in Int. J. Number Theory, 09, (2013), pp.517-543*.*
- *Équidistribution et Variétés de Shimura*
- *Geometric result on representations of reductive Lie groups* *(joint work with Nimish Shah; a version augmented with newer results below is published in Erg. Th. Dyn. Syst.)*
- *Résultat géométrique sur les représentations de groupe réductifs sur un corps ultramétrique.*
  Open access available at https://arxiv.org/abs/1706.00301

- *On narrowness for translated algebraic probabilities in S-arithmetic homogeneous spaces*

References and previous managers

- ***Nimish* Shah**, *Professor, Ohio state University.*
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  ☎ *+44 20 7679 2861*
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  http://www.ucl.ac.uk/~ucahaya/
- ***Emmanuel* Ullmo**, *Professor (Univ. Paris-Saclay). Director (IHÉS)..*
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- ***Emmannuel* Breuillard**, *Professor, Universität Münster.*
  PhD report reviewer, Manager 2018-2019
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- ***Bas* Edixhoven**, *Leiden Universiteit.*
- ***Philippe* Michel**, *Professor, EPF Lausanne.*
  Manager 2009-2013
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  ✉ *philippe.michel@epfl.ch*
  https://people.epfl.ch/philippe.michel
- ***Gareth* Jones**, *senior lecturer, University of Manchester..*
  Manager since 2023
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  https://personalpages.manchester.ac.uk/staff/Gareth.Jones-3/index.php
- ***Martin* Orr**, *Neumann Fellow, University of Manchester..*
  Manager since 2023
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https://personalpages.manchester.ac.uk/staff/Martin.Orr/

- ***Mohamed*** **Bouri**, *Professor, EPF Lausanne.*
  Manager 2013 - 2014
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