

Christopher-Lloyd Simon

Doctor in Mathematics

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Education and Positions

- 2025–2027 **PostDoc, IRMAR, UMR 6625, Rennes**, (ERC Groups of Algebraic Transformations).
- 2022–2025 **S. Chowla Research Assistant Professor, The Pennsylvania State University**.
- 2019–2022 **Doctoral Thesis in Mathematics, Laboratoire Paul Painlevé**, Université de Lille, supervised by Étienne Ghys and Patrick Popescu-Pampu.
- 2015–2018 **Master in mathematics, ENS Lyon**, Specialization in Groups and Geometry.
- 2013–2015 **Maths-Sup, Maths-Spé, Lycée Louis-Le-Grand**, Paris.

Research Interests in keywords

Modular Arithmetic	binary quadratic forms, Gauss composition, Modular forms, Poincaré series, continued fractions, intersections numbers and linking numbers of modular geodesics.
Geometry of groups	Representations of Fuchsian groups and mapping class groups, moduli spaces, character varieties, actions on trees, bounded cohomology.
Arithmetic Dynamics	Diophantine approximation, continued fractions, interval exchanges, translation surfaces, renormalisation, subshifts of low complexity and S-adic representations.
3-manifold Topology	Surgery and cobordism distances between 3-manifolds, Gordian space of knots, linking forms and Blanchfield pairings, signatures and characteristic classes.
Singularity theory	Topological classification of singular curves in surfaces, real or complex, algebraic or analytic, using chord diagrams, linking forms, Witt-rings, cluster algebras.
Combinatorial Algebra	Graphs in surfaces, chord diagrams, their polynomial invariants and Hopf algebras. Enumeration using formal generating series and analyzing their singularities.

Languages and Computer skills

English	Native ; fluent	CAE : Grade A, Level C2.
French	Native ; fluent.	
Spanish	Scholar level.	Baccalauréat : level B2.
Latex	articles, memoirs, thesis and beamer presentations	
Python	Algorithms and computations dealing with symmetric groups and generating series ; with continued fractions, the modular group, Fricke polynomials and linking numbers.	

Thesis (2019-2022)

Title	Arithmetic and Topology of Modular Knots
Supervisors	Étienne Ghys and Patrick Popescu-Pampu
Description	The modular group $PSL_2(\mathbb{Z})$ acts on the hyperbolic plane with quotient the modular orbifold, whose unit tangent bundle is a 3-manifold homeomorphic to the complement of the trefoil knot in the 3-sphere, endowed with the geodesic flow. I study the linking numbers of periodic orbits and relate them to the arithmetics of quadratic forms, the special values of Poincaré series, and the bounded cohomology of $PSL_2(\mathbb{Z})$.

Master thesis (2016-2018)

Title	<i>Topology and enumeration of real planar algebraic curves</i>
Supervisor	Étienne Ghys
Description	The topology of a real planar algebraic curve is described in the neighborhood of a singularity by a combinatorial invariant, namely a chord diagram. Most chord diagrams do not arise as such, we characterize which ones do, and enumerate them. We introduce the concept of <i>combinatorial curves</i> , enriching that of combinatorial maps, in order to describe the global topology of connected singular algebraic curves in the real sphere. From there, we count their topological types and deduce a bound on the number of connected singular algebraic curves of a given degree in the real projective plane.

Supervised Research Experiences as a Visiting student

Spring 2019	Julien Marché , <i>IMJ-PRG</i> , 5 months. Character varieties : compactifications and automorphisms. (Publication [2] available online.)
Autumn 2018	Étienne Ghys , <i>ENS Lyon</i> , 4 months. Cobordism distances between 3-manifolds. (Work in slow progress, available some day)
Summer 2018	Étienne Ghys , <i>UMPA, Lyon and IMPA, Rio-de-Janeiro</i> , 4 months. Topology and combinatorics of the singularities of plane real algebraic curves. (Publication [5] and slides in french available on demand.)
Summer 2017	Moira Chas and Dennis Sullivan , <i>Stony Brook, New York</i> , 3 months. Low dimensional topology : equivalencies of curves in hyperbolic surfaces. (Written report in english available on demand.)
Summer 2016	Jean-Pierre Wintenberger , <i>IRMA Strasbourg</i> , 2 months. Research experience on L-functions and modular forms. (Written report in french available on demand.)

Organizing activities

- Dec. 2019 **Week-end mathématique pour les élèves de l'ENS Lyon**, Château du Goutelas, Alain Connes, Calcul différentiel quantique et fonction zeta de Riemann.
Edition d'un compte rendu : <https://jmeenslyon.wordpress.com/hors-serie/>
- Nov. 2019 **Conférence en l'honneur de Bruno Sevennec**, Château du Goutelas, 3 jours, Equation de Joanolou, Spectre du Laplacien, Groupe modulaire.
<http://perso.ens-lyon.fr/sevennec/GoutelasNovembre2019/>
- Nov. 2018 **Week-end mathématique pour les élèves de l'ENS Lyon**, Château du Goutelas, Nalini Anantharaman, Géométries aléatoires.

Students

- 2025 **Undergraduate Research Experience**, Eric Seo (supervised with Ben Stucky), The complexity of pinning simple multiloops.
- 2024 **Undergraduate Research Experience**, Ryan Pham (supervised with Ben Stucky), Implementing the Schor–Van-Wick algorithm to compute pinning ideals of loops.
[This project was mentioned here.](#)
- 2023 **Undergraduate Research Experience**, Mayank Yadav, Combinatorics of chord diagrams and their interlace graphs.
<https://github.com/mayankyadavblr>

Teaching activities

- Spring 2025 **MATH 597, 5 credits**, PSU, Integrable Systems, T.A. of Prof. Sergei Tabachnikov.
- Spring 2025 **MATH 310, 3 credits**, PSU, Elementary Combinatorics.
- Autumn 2024 **MATH 141, 4 credits**, PSU, Calculus with Analytic Geometry II, Instructor.
- Spring 2024 **MATH 141, 4 credits**, PSU, Calculus with Analytic Geometry II, Instructor.
- Autumn 2023 **MATH 141, 4 credits**, PSU, Calculus with Analytic Geometry II, Instructor.
- Spring 2023 **MATH 311W, 3 credits**, PSU, Discrete mathematics, Instructor.
- Autumn 2022 **MATH 141, 4 credits**, PSU, Calculus with Analytic Geometry II, Instructor.
- Spring 2021 **TD (exercise sessions) 36h**, Univ. Lille, Fonctions de plusieurs variables L2.
- Spring 2020 **TD (exercise sessions) 24h**, Univ. Lille, Probabilités discrètes L2.
- Spring 2020 **TD (exercise sessions) 36h**, Univ. Lille, Calcul différentiel L3.
- 2016-2017 **Colles (exercise sessions) 72h**, Prépa du Parc de Lyon, MP*.

Mathematical awareness

- Summer 2021 **Article en ligne**, *Images des mathématiques*, Un rebondissement inattendu.
<https://doi.org/10.60868/yz12-p539>
- Spring 2018 **Conférence**, Séminaire de la détente mathématique de l'ENS Lyon, Courbes, cartes et dessins d'enfants.
<https://indico.math.cnrs.fr/event/3142/>
- Spring 2017 **Conférence**, Prépa du Parc, Lyon, Topologie et combinatoire des courbes planes.

Spring 2016 **Conférence**, *Séminaire de la détente mathématique de l'ENS Lyon*, Théorème de Brower via le lemme de Sperner.

<https://www.umpa.ens-lyon.fr/seminaires/detente>

Invited talks in conferences and seminars

- Nov. 2025 **Théorie ergodique**, *IRMAR*, La dimension de Hausdorff d'un ensemble de convergence.
[https://irmar.univ-rennes.fr/seminars?f\[0\]=seminar_type%3A241](https://irmar.univ-rennes.fr/seminars?f[0]=seminar_type%3A241)
- Aug. 2025 **GGD+NCG**, *Texas AMU*, Pseudocharacters of the modular group from linking numbers of modular knots.
<https://artsci.tamu.edu/mathematics/research/seminars/geometry>
- May 2025 **Departement Colloquium**, *Neuchâtel*, Arithmetic and Topology of Modular Knots.
<https://www.unine.ch/evenement/colloque-du-mardi>
- Jan. 2025 **Perspectives on Markov Numbers**, *Banff IRS*, Workshop (25w5411), Markov numbers and diophantine approximation of hyperbolic geodesics.
<https://www.birs.ca/events/2025/5-day-workshops/25w5411/videos>
- Oct. 2024 **Geometry Lunch Seminar**, *The Pennsylvania State University*, Complexity of pinning loops in the plane.
<https://math-cal.cloud.science.psu.edu/events/74691>
- June 2024 **Séminaire Géométrie Topologie Dynamique**, *Orsay, Université Paris-Saclay*, Valuations on the character variety : Newton Polygons and residual Poisson brackets.
<https://www.imo.universite-paris-saclay.fr/fr/events/7333>
- April 2024 **Philadelphia Area Number Theory Seminar**, *Bryn Mawr College*, Arithmetic and Topology of Modular Knots.
[Bryn Mawr Calendar to the Philadelphia Area Number Theory Seminar](#)
- April 2024 **Seminar**, *Princeton*, Arithmetics and Dynamics of the Hexponential map.
<https://www.math.princeton.edu/events/arithmetics-and-dynamics-2024-04>
- Feb. 2024 **Student Colloquium Seminar**, *The Pennsylvania State University*, TopoloGames : "hang the chain" and "pin the loop".
<https://math-cal.cloud.science.psu.edu/events/73782>
- Feb. 2024 **GAP Seminar**, *The Pennsylvania State University*, Loops in surfaces, chord diagrams and interlace graphs : minimal genus.
<https://math-cal.cloud.science.psu.edu/events/72378>
- Dec. 2023 **Monodromy and its Applications, Conference in honor of Nicholas Katz**, *Princeton*, Short talk, Quasicharacters of the modular group from linking numbers of modular knots.
<https://sites.google.com/princeton.edu/katz80>
- Aug. 2023 **Algebraic, Asymptotic and Enumerative Combinatorics**, *Summer School in Bedlewo, Poland*, Short talk, Combinatorics and enumeration of chord diagrams.
<https://sites.google.com/impan.pl/23-summeralgcom/home>
- June 2023 **Geometric group theory, low-dimensional geometry and topology**, *ICMAT, Madrid*, Arithmetic and topology of modular knots.
<https://www.icmat.es/RT/2023/GGTLGDT/index.php>
- April 2023 **Dynamical Systems Seminar**, *The Pennsylvania State University*, Linking forms and quasi-morphisms of Fuchsian groups.
<https://math-cal.cloud.science.psu.edu/events/seminar/439>

- April 2023 **GAP Seminar**, *The Pennsylvania State University*, Valuations on the character variety : Newton Polygons and residual Poisson brackets.
<https://math-cal.cloud.science.psu.edu/events/seminar/408>
- Dec. 2022 **Le séminaire virtuel francophone Groupes et Géométrie**, *Université Joseph Fourier, Grenoble*, Arithmétique et topologie des noeuds modulaires.
<https://www-fourier.univ-grenoble-alpes.fr/seminaire-gg/?q=node/84>
- Oct. 2022 **Algebra and Number Theory Seminar**, *The Pennsylvania State University*, Conjugacy classes in $\mathrm{PSL}_2(\mathbb{K})$ and genera of binary quadratic forms.
<https://math-cal.cloud.science.psu.edu/events/seminar/372>
- Nov. 2022 **Geometry/Topology Seminar**, *Brown University*, Linking numbers of modular knots.
<https://www.math.brown.edu/reschwar/seminar.html>
- Oct. 2022 **Dynamical Systems Working Seminar**, *The Pennsylvania State University*, Linking numbers of modular knots.
<https://math-cal.cloud.science.psu.edu/events/seminar/400>
- Oct. 2022 **Department of Mathematics Colloquium**, *The Pennsylvania State University*, Arithmetic and Topology of Modular Knots.
<https://math-cal.cloud.science.psu.edu/events/seminar/377>
- June 2022 **Séminaire de Géométrie des Espaces Singuliers**, *Laboratoire Painlevé, Lille*, Arithmétique et topologie des noeuds modulaires.
<https://pro.univ-lille.fr/patrick-popescu-pampu/respondabilites/>
- June 2022 **Conference in enumerative, real and birational geometry**, 1 week in *Le Croisic*, Topology and enumeration of real planar algebraic curves.
<https://math.univ-angers.fr/~zimmermann/Croisic/Croisic.html>
- May 2022 **Séminaire de Géométrie des Espaces Singuliers**, *Laboratoire Painlevé, Lille*, Valuations on the character variety : Newton polygons and residual Poisson bracket.
<https://pro.univ-lille.fr/patrick-popescu-pampu/respondabilites/>
- Jan. 2022 **Séminaire de Géométrie des Espaces Singuliers**, *Laboratoire Painlevé, Lille*, Arithmetic equivalence of modular geodesics, (Series of two talks).
<https://pro.univ-lille.fr/patrick-popescu-pampu/respondabilites/>
- April 2020 **Séminaire de Géométrie complexe**, *Nancy*, online, Automorphismes des variétés de caractères.
<https://iecl.univ-lorraine.fr/events/categories/geometrie/>
- 2019–2020 **Séminaire de Géométrie des Espaces Singuliers**, *Laboratoire Painlevé, Lille*, (Series of talks : Nov, Dec, Jan), Conjugacy classes in the modular group.
<https://math.univ-lille1.fr/d7/sgeoessing>
- Nov. 2019 **Conference Géométrie et Dynamique**, *Goutelas*, en l'honneur de B. Sevennec, Distances pour le cobordisme entre les 3-variétés.
<http://perso.ens-lyon.fr/sevennec/GoutelasNovembre2019/>
- April 2019 **Séminaire Géométrie et Topologie**, *IMJ-PRG, Paris*, Topologie et combinatoire des courbes algébriques réelles singulières.
<https://www.imj-prg.fr/gestion/evnemement/affSeance/6486>

Dec. 2018 **Séminaire de Combinatoire**, *ENS Lyon*, Topologie et combinatoire des courbes algébriques réelles.

<https://indico.math.cnrs.fr/event/3370/>

Nov. 2018 **Séminaire de Géométrie des Espaces Singuliers**, *Laboratoire Painlevé, Lille*, Topologie et dénombrement des courbes algébriques réelles singulières.

<https://math.univ-lille1.fr/d7/sgeoessing>

Participation in Thematic Schools and Conferences

Oct. 2025 **Combinatorics, Automata, and Number Theory**, *CIRM, Marseille*, Conference.
<https://conferences.cirm-math.fr/3355.html>

Sept. 2025 **Higher dimensional hyperbolic geometry**, *Ventotene, Italy*, Conference.
<https://www.ventoteneinternationalworkshops.net/>

Aug. 2025 **Finite Dimensional Integrable Systems in Geometry & Mathematical Physics**, *Guanajuato, Mexico*, CIMAT.
https://fdis2025.eventos.cimat.mx/home_fdis2025

June 2025 **Groups, Logic and Computation**, *Stevens Institute of Technology*, GAGTA.
<https://web.stevens.edu/algebraic/Stevens2025/>

May 2025 **Anniversaire Étienne Ghys**, *Villers-le-Lac*, Évasion tonique.
<https://mtriestino.perso.math.cnrs.fr/EG70programme.html>

May 2025 **Frieze patterns in algebra, combinatorics and geometry**, *Marseille*, CIRM.
<https://conferences.cirm-math.fr/3214.html>

Jan. 2025 **Perspectives on Markov Numbers**, *Banff IRS*, Workshop (25w5411).
<https://www.birs.ca/events/2025/5-day-workshops/25w5411>

May 2024 **École de Printemps en Informatique Théorique**, *Aussois, France*.
<https://perso.ens-lyon.fr/edouard.bonnet/springSchool.htm>

Dec. 2023 **Monodromy and its Applications**, *Princeton*, Conference for Nicholas Katz.
<https://sites.google.com/princeton.edu/katz80>

Aug. 2023 **Algebraic, Asymptotic and Enumerative Combinatorics**, *Będlewo, Poland*, Combinatorics and enumeration of chord diagrams.
<https://sites.google.com/impan.pl/23-summeralgcom/home>

July 2023 **Group actions and low-dimensional topology**, *Conference in El Barco de Avila*.
<https://www.icmat.es/RT/2023/GGTLGDT/week4.php>

June 2023 **Geometric group theory, low-dimensional geometry and topology**, *Madrid*, ICMAT, Workshop on Orderings and Groups ; Workshop on Profinite Rigidity.
<https://www.icmat.es/RT/2023/GGTLGDT/index.php>

June 2022 **Conference in enumerative, real and birational geometry**, *1 week in Le Croisic*.
<https://math.univ-angers.fr/~zimmermann/Croisic/Croisic.html>

Nov. 2019 **Géométrie & Dynamique**, *Goutelas*, week-end in honor of Bruno Sevennec.
<http://perso.ens-lyon.fr/sevennec/GoutelasNovembre2019/>

May 2019 **Geometry and Topology of singularities**, *Budapest*, 1 week conference in honor of András Némethi.
<https://ap60.sciencesconf.org/>

- April 2019 **Singularités réelles et complexes à Cargèse**, Cargèse, 1 week conference in honor of Adam Parusiński.
www.renyi.hu/conferences/nemethi60
- Jan 2019 **Groups and geometries**, Marseille, CIRM, 1 week master class.
<https://mcgg.sciencesconf.org/>
- Aug. 2018 **ICM**, Rio de Janeiro, Brasil.
www.icm2018.org
- June 2018 **Teichmüller dynamics, mapping class groups and applications**, Institut Fourier, Grenoble, France, 3 week school.
<https://if-summer2018.sciencesconf.org/>

Research in Groups

- 2023-2024 **JGA**, *Research in groups on graphs and algorithms*, with Pierre Aboulker, Nacim Oijid, Robin Petit, Mathis Rocton, Computing the degreewidth of a digraph is hard.
arXiv version [\[10\]](#)

List of (Pre)Publications

Accepted for Publication

- [1] Étienne GHYS et Christopher-Lloyd SIMON. "On the topology of a real analytic curve in the neighborhood of a singular point". In : *Astérisque* Some aspects of the theory of dynamical systems : a tribute to Jean-Christophe Yoccoz. Vol. I.415 (2020). [HAL version](#), p. 1–33. ISSN : 0303-1179,2492-5926. DOI : [10.24033/ast](https://doi.org/10.24033/ast). URL : <https://doi.org/10.24033/ast>.
- [2] Julien MARCHÉ et Christopher-Lloyd SIMON. "Automorphisms of character varieties". In : *Ann. H. Lebesgue* 4 (2021). [arXiv version](#), p. 591–603. ISSN : 2644-9463. DOI : [10.5802/ahl.82](https://doi.org/10.5802/ahl.82). URL : <https://doi.org/10.5802/ahl.82>.
- [3] Christopher-Lloyd SIMON. "Un rebondissement inattendu". In : *Images des mathématiques* (2021). DOI : [10.60868/yz12-p539](https://doi.org/10.60868/yz12-p539).
- [4] Christopher-Lloyd SIMON. "Arithmetic and Topology of Modular knots". [HAL version](#). Thèse. Université de Lille, juin 2022. URL : <https://tel.archives-ouvertes.fr/tel-03755147>.
- [5] Christopher-Lloyd SIMON. "Topologie et dénombrement des courbes algébriques réelles". In : *Ann. Fac. Sci. Toulouse Math.* (6) 31.2 (2022). [arXiv version](#), p. 383–422. ISSN : 0240-2963,2258-7519. DOI : [10.5802/afst.1698](https://doi.org/10.5802/afst.1698). URL : <https://doi.org/10.5802/afst.1698>.
- [6] Christopher-Lloyd SIMON. "Conjugacy classes in $\mathrm{PSL}_2(\mathbb{K})$ ". en. In : *Mathematics Research Reports* 4 (2023). [arXiv version](#), p. 23–45. DOI : [10.5802/mrr.16](https://doi.org/10.5802/mrr.16). URL : <https://mrr.centre-mersenne.org/articles/10.5802/mrr.16/>.
- [7] Julien MARCHÉ et Christopher-Lloyd SIMON. "Valuations on the character variety : Newton polytopes and residual Poisson bracket". In : *Geom. Topol.* 28.2 (2024). [arXiv version](#), p. 593–625. ISSN : 1465-3060,1364-0380. DOI : [10.2140/gt.2024.28.593](https://doi.org/10.2140/gt.2024.28.593). URL : <https://doi.org/10.2140/gt.2024.28.593>.
- [8] Christopher-Lloyd SIMON. "Linking numbers of modular knots". In : *Geometry and Topology* 29.6 (2025), p. 3241–3270. DOI : [10.2140/gt.2025.29.3241](https://doi.org/10.2140/gt.2025.29.3241).

Submitted and in Revision

- [9] Christopher-Lloyd SIMON. *Loops in surfaces, chord diagrams, interlace graphs : operad factorisations and generating grammars*. Submitted for publication, [arXiv version](#). 2023.
- [10] Pierre ABOULKER et al. *Computing the degreewidth of a digraph is hard*. Submitted for publication, [arXiv version](#). 2024. arXiv : [2407.19270 \[math.CO\]](https://arxiv.org/abs/2407.19270). URL : <https://arxiv.org/abs/2407.19270>.
- [11] Scott SCHMIEDING et Christopher-Lloyd SIMON. *Geometry and Transcendence of the Hexponential*. Submitted for publication, [arXiv version](#). 2024. arXiv : [2402.17628 \[math.NT\]](https://arxiv.org/abs/2402.17628). URL : <https://arxiv.org/abs/2402.17628>.
- [12] Scott SCHMIEDING et Christopher-Lloyd SIMON. *Isogenies of low complexity systems : Sturmian, Denjoy, and interval exchange systems*. Submitted for publication, [arXiv version](#). 2024.
- [13] Christopher-Lloyd SIMON et Ben STUCKY. *The pinning poset of a multiloop*. Submitted for publication. 2024. arXiv : [2405.16216 \[math.GT\]](https://arxiv.org/abs/2405.16216). URL : <https://arxiv.org/abs/2405.16216>.