

# Christopher-Lloyd Simon

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« *Connaître ce n'est point démontrer, ni expliquer.  
C'est accéder à la vision.* » (Antoine de Saint-Exupéry)

## Education and Positions

- 2022–2025 **S. Chowla Research Assistant Professor**, *Pennsylvania State University*.
- 2019–2022 **Thesis in mathematics**, *Laboratoire Paul Painlevé de Lille*, Linking forms of Fuchsian groups, supervised by Étienne Ghys and Patrick Popescu-Pampu.
- 2016–2018 **Master in mathematics**, *ENS Lyon*, Specialization in groups and geometry.
- 2015–2016 **Licence de mathématiques**, *ENS Lyon*.
- 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 Blanch field 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.

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## Thesis (2019-2022)

- Title Arithmetic and topology of modular knots  
Supervisors Étienne Ghys and Patrick Popescu-Pampu  
Description The modular group  $\mathrm{PSL}_2(\mathbb{Z})$  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  $\mathrm{PSL}_2(\mathbb{Z})$ .

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## Master thesis (2016-2018)

- Title *Topology and enumeration of real planar algebraic curves*  
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 *combinatorial curves*, 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.

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## Supervised Research Experiences as a Visiting student

- Spring 2019 **Julien Marché**, *IMJ-PRG*, 5 months.  
Character varieties : compactifications and automorphisms.  
(Publication [[MS21](#)] available online.)
- Autumn 2018 **Étienne Ghys**, *ENS Lyon*, 4 months.  
Cobordism distances between 3-manifolds.  
(Work in slow progress, available some day)
- Summer 2018 **Étienne Ghys**, *UMPA, Lyon and IMPA, Rio-de-Janeiro*, 4 months.  
Topology and combinatorics of the singularities of plane real algebraic curves.  
(Publication [[Sim22c](#)] and slides in french available on demand.)
- Summer 2017 **Maira Chas and Dennis Sullivan**, *Stony Brook, New York*, 3 months.  
Low dimensional topology : equivalencies of curves in hyperbolic surfaces.  
(Written report in english available on demand.)
- Summer 2016 **Jean-Pierre Wintenberger**, *IRMA Strasbourg*, 2 months.  
Research experience on L-functions and modular forms.  
(Written report in french available on demand.)

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## Organising 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.

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## Students

- 2023 **Undergraduate Research Experience**, *Independant Studies*, Mayank Yadav, Combinatorics of chord diagrams and their interlace graphs.  
<https://github.com/mayankyadavblr>

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## Teaching activities

- Autumn 2024 **MATH 141, 4 credits**, *Penn. State Univ.*, Calculus with Analytic Geometry II.  
Spring 2024 **MATH 141, 4 credits**, *Penn. State Univ.*, Calculus with Analytic Geometry II.  
Autumn 2023 **MATH 141, 4 credits**, *Penn. State Univ.*, Calculus with Analytic Geometry II.  
Spring 2023 **MATH 311W, 3 credits**, *Pennsylvania State University*, Discrete mathematics.  
Autumn 2022 **MATH 141, 4 credits**, *Penn. State Univ.*, Calculus with Analytic Geometry II.  
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\*.

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## Mathematical awareness

- Summer 2021 **Article en ligne**, *Images des mathématiques*, Un rebondissement inattendu.  
<https://images.math.cnrs.fr/Un-rebondissement-inattendu>
- 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 Brouwer via le lemme de Sperner.  
<https://www.umpa.ens-lyon.fr/seminaires/detente>

## (Pre)Publications

- [AOP<sup>+</sup>24] Pierre Aboulker, Nacim Oijid, Robin Petit, Mathis Rocton, and Christopher-Lloyd Simon. Computing the degreewidth of a digraph is hard, 2024. Submitted for publication, [arXiv version](#).
- [GS20] Étienne Ghys and Christopher-Lloyd Simon. On the topology of a real analytic curve in the neighborhood of a singular point. *Astérisque*, Some aspects of the theory of dynamical systems : a tribute to Jean-Christophe Yoccoz. Vol. I(415) :1–33, 2020. [HAL version](#).
- [MS21] Julien Marché and Christopher-Lloyd Simon. Automorphisms of character varieties. *Ann. H. Lebesgue*, 4 :591–603, 2021. [arXiv version](#).
- [MS24] Julien Marché and Christopher-Lloyd Simon. Valuations on the character variety : Newton polytopes and residual Poisson bracket. *Geom. Topol.*, 28(2) :593–625, 2024. [arXiv version](#).
- [Sim22a] Christopher-Lloyd Simon. *Arithmetic and Topology of Modular knots*. Thèse, Université de Lille, June 2022. [HAL version](#).
- [Sim22b] Christopher-Lloyd Simon. Linking numbers of modular knots, 2022. Submitted for publication, [arXiv version](#).
- [Sim22c] Christopher-Lloyd Simon. Topologie et dénombrement des courbes algébriques réelles. *Ann. Fac. Sci. Toulouse Math. (6)*, 31(2) :383–422, 2022. [arXiv version](#).
- [Sim23a] Christopher-Lloyd Simon. Conjugacy classes in  $\mathrm{PSL}_2(\mathbb{K})$ . *Mathematics Research Reports*, 4 :23–45, 2023. [arXiv version](#).
- [Sim23b] Christopher-Lloyd Simon. Loops in surfaces, chord diagrams, interlace graphs : operad factorisations and generating grammars, 2023. Submitted for publication, [arXiv version](#).
- [SS24a] Scott Schmieding and Christopher-Lloyd Simon. Geometry and transcendence of the exponential, 2024. Submitted for publication, [arXiv version](#).
- [SS24b] Scott Schmieding and Christopher-Lloyd Simon. Isogenies of minimal Cantor systems : Sturmian, denjoy, and interval exchange systems, 2024. In preparation.
- [SS24c] Christopher-Lloyd Simon and Ben Stucky. Pin the loop taut : a one-player topolo-game, 2024. Submitted for publication, [arXiv version](#).

## Invited talks in conferences and seminars

- Jan. 2025 **Workshop**, *Banff IRS*, Perspectives on Markov Numbers (25w5411).  
<https://www.birs.ca/events/2025/5-day-workshops/25w5411>
- Oct. 2024 **Geometry Lunch Seminar**, *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 Maur College*, Arithmetic and Topology of Modular Knots.  
[Bryn Maur 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**, *Pennsylvania State University*, TopoloGames : "hang the chain" and "pin the loop".  
<https://math-cal.cloud.science.psu.edu/events/73782>
- Feb. 2024 **GAP Seminar**, *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/GGTLDGT/index.php>
- April 2023 **Dynamical Systems Seminar**, *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**, *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**, *Pennsylvania State University*, Conjugacy classes in  $PSL_2(\mathbb{K})$  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**, *Pennsylvania State University*, Linking numbers of modular knots.  
<https://math-cal.cloud.science.psu.edu/events/seminar/400>
- Oct. 2022 **Department of Mathematics Colloquium**, *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/responsabilites/>
- 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/responsabilites/>
- 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/responsabilites/>
- 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/evenement/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>

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## Participation in Thematic Schools and Conferences

- Jan. 2025 **Workshop, Banff IRS**, Perspectives on Markov Numbers (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, Conference in honor of Nicholas Katz**, Princeton.  
<https://sites.google.com/princeton.edu/katz80>
- Aug. 2023 **Algebraic, Asymptotic and Enumerative Combinatorics**, Summer School in 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/GGTLDT/week4.php>
- June 2023 **Geometric group theory, low-dimensional geometry and topology**, ICMAT, Madrid, Workshop on Orderings and Groups; Workshop on Profinite Rigidity.  
<https://www.icmat.es/RT/2023/GGTLDT/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](http://www.renyi.hu/conferences/nemethi60)
- Jan 2019 **Groups and geometries**, CIRM, 1 week master class.  
<https://mcgg.sciencesconf.org/>
- Aug. 2018 **ICM**, Rio de Janeiro, Brasil.  
[www.icm2018.org](http://www.icm2018.org)
- June 2018 **Teichmüller dynamics, mapping class groups and applications**, Institut Fourier, Grenoble, France, 3 week school.  
<https://if-summer2018.sciencesconf.org/>