

# Christopher-Lloyd Simon

*Doctor in Mathematics*

217 McAllister Building  
16802, State College  
Pennsylvania, USA

✉ [christopher-lloyd.simon@univ-rennes.fr](mailto:christopher-lloyd.simon@univ-rennes.fr)

📄 [christopherlloyd.github.io](https://github.com/christopherlloyd)

ORCID:0000-0002-8195-2550



## 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 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. |                          |

---

## 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  $\mathrm{PSL}_2(\mathbb{Z})$ .

---

## 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.

---

## Supervised Research Experiences as a Visiting student

- Spring 2019 **Julien Marché**, *IMJ-PRG*, 5 months.  
Character varieties : compactifications and automorphisms.  
(Publication [2] 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 [5] 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.)

---

## 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 Brouwer 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 **Département 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 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**, *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/GGTLDT/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/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, Automorphisms 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>

## 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](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/GGTLDT/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/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**, *Marseille*, 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/>

---

## Research in Groups

- 2023-2024 **JGA**, *Research in groups on graphs and algorithms*, with Pierre Aboulker, Nacim Oijid, Robin Petit, Mathis Rocton, Computing the degreeewidth 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](https://arxiv.org/abs/2407.19270) [[math.CO](#)]. 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](https://arxiv.org/abs/2402.17628) [[math.NT](#)]. 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](https://arxiv.org/abs/2405.16216) [[math.GT](#)]. URL : <https://arxiv.org/abs/2405.16216>.