

CURRICULUM VITAE

Carlos Matheus Silva Santos

PERSONAL DATA

Name: Carlos Matheus Silva Santos

Date of birth: May 1st, 1984

Birthplace: Aracaju - SE - Brazil

ACADEMIC DEGREES

B. Sc. in Mathematics at UFRJ - Universidade Federal do Rio de Janeiro (2005).

M. Sc. in Mathematics at IMPA - Instituto de Matemática Pura e Aplicada (2000) under the direction of prof. Carlos Gustavo Moreira.

Ph.D. in Mathematics at IMPA (2004). Advisor: prof. Marcelo Viana. Thesis: *Contributions to the ergodic theory of non-hyperbolic systems.*

Habilitation at Univ. Paris 13 (2017). Thesis: *Quelques contributions à la théorie de l'action de $SL(2, \mathbb{R})$ sur les espaces de modules de surfaces plates.*

CURRENT POSITION AND PREVIOUS AFFILIATIONS

Directeur de Recherche (DR2) (since October 2018) at CNRS

CMLS, École Polytechnique

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Chargé de Recherches (2010–2018) at LAGA, CNRS - Univ. Paris 13

ATER PostDoc (2008–2010) at Collège de France under the direction of prof. Jean-Christophe Yoccoz

ANR PostDoc (2007–2008) at Collège de France under the direction of prof. Jean-Christophe Yoccoz

CNPq PostDoc (2004–2007) at IMPA under the direction of prof. Marcelo Viana

PARTICIPATIONS IN EDITORIAL BOARDS

Survey editor for *Ergodic Theory and Dynamical Systems* (since March 2016).

REFEREE

Referee for the journals:

- *Acta Mathematica*,
- *Advances in Mathematics*,
- *Algebraic and Geometric Topology*,
- *Annals of Mathematics*,
- *Annales Scientifiques de l'École Normale Supérieure*,
- *Annales de l'Institut Fourier*,
- *Annales de l'Institut Henri Poincaré (Analyse non Linéaire)*,
- *Astérisque*,
- *Bulletin de la SMF*,
- *Bulletin of the American Mathematical Society*,
- *Bulletin of the Brazilian Mathematical Society*,
- *Bulletin of the London Mathematical Society*,
- *Commentarii Mathematici Helvetici*,
- *Duke Mathematical Journal*,
- *Dynamics of Partial Differential Equations*,
- *Electronic Journal of Combinatorics*,
- *Ergodic Theory & Dynamical Systems*,
- *Experimental Mathematics*,
- *Fundamenta Mathematicae*,
- *Geometric and Functional Analysis*,
- *Geometry and Topology*,
- *Inventiones Mathematicae*,
- *Israel Journal of Mathematics*,
- *Journal of the American Mathematical Society*,
- *Journal of the Institute of Mathematics of Jussieu*,
- *Journal de Mathématiques Pures et Appliquées*,
- *Journal of Modern Dynamics*,
- *Journal of Statistical Physics*,
- *Mathematical Proceedings of the Cambridge Philosophical Society*,
- *Mathematical Research Letters*,
- *Mathematische Nachrichten*,
- *Nonlinearity* and
- *Pure and Applied Mathematics Quarterly*.

TEACHING

Course: Riemann surfaces (August – November 2006); Institution: IMPA.

Course: Introduction to Teichmüller theory and its applications to dynamics of interval exchange transformations, flows on surfaces and billiards (July 4–15, 2011). Taught together with prof. Giovanni Forni. Institution: Banach Center, Bedlewo, Poland.

- Course: Birkhoff sums for interval exchange maps: the Kontsevich-Zorich cocycle (May 21–June 1, 2012). Taught together with prof. Jean-Christophe Yoccoz. Institution: ICTP, Trieste, Italy.
- Course: Dynamics of the Weil-Petersson geodesic flow (November 25–29, 2013). Taught together with prof. Keith Burns and prof. Boris Hasselblatt. Institution: CIRM, Luminy, France.
- Course: Introduction to the dynamics of the Teichmüller flow (August–November 2015); Institution: IMPA.
- Course: The Lagrange and Markov spectra from the dynamical point of view (October 17 & 19, 2016). Institution: CIRM, Luminy, France.
- Course: Exposants de Lyapunov (October–December 2016); Institution: Univ. Paris 7.
- Course: Surfaces à petits carreaux et leurs exposants de Lyapunov (January–February 2017); Institution: Univ. Paris 13.
- Course: Surfaces à petits carreaux (November–December 2017); Institution: Univ. Paris 7.
- Course: Part time professor (since 2017/2018) at École Polytechnique.
- Course: Square-tiled surfaces (June 11–13, 2018). Institution: Institut Fourier, Grenoble, France.

M.SC, PhD AND POST-DOCTORAL STUDENTS

- Supervision of Elise Goujard’s M.SC. stage (ENS Cachan, France). Memoir: *Revêtements cycliques à petits carreaux* (2011).
- Co-advisor of Rodolfo Gutiérrez (Univ. Paris 7). Ph.D thesis co-directed with prof. Anton Zorich (Univ. Paris 7) since September 2016. Article from the thesis: *Classification of Rauzy–Veech groups: proof of the Zorich conjecture*, to appear in **Invent. Math.** (2018).
- Supervision of the post-doctoral visit of of Mauricio Poletti for one-year at LAGA (Univ. Paris 13) since January 2017.

ORGANIZATION OF EVENTS

- Co-organizer with L. Marchese, T. Monteil and A. Sportiello of *Journées de Géométrie et Combinatoire dans les Espaces des Modules* (September 24–25, 2018), Université Paris 13, Villetaneuse, France.
- Co-organizer with J. Chaika and J. Tao of *Summer School on Teichmüller Theory and its Connections to Geometry, Topology and Dynamics* (August 20–24, 2018) Fields institute, Toronto, Canada.
- Co-organizer with P. Berger and S. Crovisier of *A conference in memory of Jean-Christophe Yoccoz* (May 29–June 1, 2017), Collège de France, Paris, France.
- Co-organizer with A. Avila, S. Crovisier, J. Palis, M. Viana and J.-C. Yoccoz of the *International Conference on Dynamical Systems* (July 4–8, 2016), Búzios, RJ, Brazil.

Co-organizer with C. Mauduit, C. Moreira, Y. Lima and J.-C. Yoccoz of the *2nd Workshop on Combinatorics, Number Theory and Dynamical Systems* (August 24–28, 2015), IMPA, Rio de Janeiro, Brazil.

Co-organizer with Sylvain Crovisier of the *Third Palis-Balzan International Symposium on Dynamical Systems* (June 14–20, 2015), Institut Henri Poincaré, Paris, France.

Co-organizer with Luca Marchese of the *Journée Surfaces Plates* (May 20, 2015), Université Paris 13, Villetaneuse, France.

Co-organizer with Sylvain Crovisier of the *Second Palis-Balzan International Symposium on Dynamical Systems* (June 10–14, 2013), Institut Henri Poincaré, Paris, France.

Co-organizer with Yuri Lima, Christian Mauduit, Carlos Gustavo Moreira and Jean-Christophe Yoccoz of the *Workshop on Combinatorics, Number Theory and Dynamical Systems* (August 19–23, 2013), Instituto de Matemática Pura e Aplicada, Rio de Janeiro, Brazil.

SEMINARS

Co-organizer with C. Favre and T. Gauthier of the seminar *DynamiX* (2018–...), École Polytechnique, France.

Co-organizer with G. Forni and A. Zorich of the seminar *Géométrie et dynamique dans les espaces de modules* (2017–...), Institut Henri Poincaré, Paris, France.

Co-organizer with A. Zorich of the seminar *Géométrie et dynamique dans les espaces de modules* (2016–2017), Institut Henri Poincaré, Paris, France.

Co-organizer with J.-C. Yoccoz and A. Zorich of the seminar *Géométrie et dynamique dans les espaces de modules* (2014–2016), Institut Henri Poincaré, Paris, France.

COLLOQUIA

Talk *Counting periodic trajectories in Sinai billiards* (on December 17, 2018) at the colloquium series of the School of Mathematics and Statistics of the Univ. College Dublin (Ireland).

PUBLICATIONS

Equilibrium states for random non-uniformly expanding maps, joint with Alexander Arbieto and Krerley Oliveira. **Nonlinearity**, vol. 17, 581-593 (2004).

Abundance of stable ergodicity, joint with Christian Bonatti, Marcelo Viana and Amie Wilkinson. **Commentarii Mathematici Helvetici**, vol. 79, 753-757 (2004).

Decidability of chaos for some families of dynamical systems, joint with A. Arbieto. **Foundations of Computational Mathematics**, vol. 4, 269-275 (2004).

The Bernoulli property for weakly hyperbolic systems, joint with A. Arbieto and Maria Pacífico. **J. Statistical Physics**, vol. 117, p. 243-260 (2004).

- Immersiones with fractal set of points of zero Gauss-Kronecker curvature*, joint with A. Arbieto and K. Oliveira, **Bulletin of the Brazilian Mathematical Society**, vol.35, p. 363-376 (2004).
- Geometrical versus Topological Properties of Manifolds*, joint with K. Oliveira, **Journal of the Institute of Mathematics of Jussieu**, vol. 4, p. 630-651 (2005).
- Rough solutions for the periodic Schrödinger - Korteweg-deVries system*, joint with A. Arbieto and Adán Corcho, **Journal of Differential Equations**, vol.230, p.295-336 (2006).
- Global well-posedness of NLS-KdV systems for periodic functions*, **Electronic Journal of Differential Equations**, vol. 2007, p. 1-20 (2007).
- A pasting lemma and some applications for conservative systems (a.k.a. "A pasting lemma I: the vector field case")*, joint with A. Arbieto, **Ergodic Theory and Dynamical Systems**, vol. 27, p. 1399-1417 (2007).
- On the periodic Schrödinger-Debye equation*, joint with A. Arbieto, **Communications in Pure and Applied Analysis**, vol. 7, p. 699-713 (2008).
- Global well-posedness and non-linear stability of periodic traveling waves for a Schrödinger-Benjamin-Ono system*, joint with Jaime Angulo and Didier Pilod, **Communications in Pure and Applied Analysis**, vol. 8, n.3, 815-844 (2009).
- Sharp bilinear estimates and well-posedness for the 1D Schrödinger-Debye system*, joint with Adán Corcho, **Differential and Integral Equations**, vol. 22, n.3-4, 357-391 (2009).
- Well-posedness for the 1D Zakharov-Rubenchik system*, joint with Felipe Linares, **Advances in Differential Equations**, vol. 14, n.3-4, 261-288 (2009).
- The action of the affine diffeomorphisms on the relative homology group of certain exceptionally symmetric origamis*, joint with Jean-Christophe Yoccoz, **Journal of Modern Dynamics**, vol. 4, n.3, 453-486 (2010).
- Square-tiled cyclic covers*, joint with Giovanni Forni and Anton Zorich, **Journal of Modern Dynamics**, vol. 5, n.2, 285-318 (2011).
- Other relevant examples*: appendix to G. Forni's article "A geometric criterion for the non-uniform hyperbolicity of the Kontsevich-Zorich cocycle", **Journal of Modern Dynamics**, vol. 5, n.2, 355-395 (2011).
- Some quantitative versions of Ratner's mixing estimates*, **Bulletin Brazilian Mathematical Society**, vol. 44, 469-488 (2013).
- $SL(2, R)$ -invariant probability measures on the moduli spaces of translation surfaces are regular*, joint with Artur Avila and Jean-Christophe Yoccoz, **Geometric and Functional Analysis**, v. 23, p. 1705-1729 (2013).
- Axiom A versus Newhouse phenomena for Benedicks-Carleson toy models*, joint with Carlos Gustavo Moreira and Enrique Pujals, **Annales Scientifiques de l'École Normale Supérieure**, vol. 46, n. 6, p. 857-878 (2013).
- Explicit Teichmüller curves with complementary series*, joint with Gabriela Weitze-Schmithüsen, **Bulletin de la Société Mathématique de France**, vol. 141, n. 4, 557-602 (2013).

- Lyapunov spectrum of invariant subbundles of the Hodge bundle*, joint with Giovanni Forni and Anton Zorich, **Ergodic Theory and Dynamical Systems**, vol. 34, n. 2, 353-408 (2014).
- Zero Lyapunov exponents of the Hodge bundle*, joint with Giovanni Forni and Anton Zorich, **Commentarii Mathematici Helvetici**, vol. 89, n. 2, 489-535 (2014).
- Homology of origamis with symmetries*, joint with Jean-Christophe Yoccoz and David Zmiaikou, **Annales de l'Institut Fourier**, vol. 64, 1131-1176 (2014).
- Un contre-exemple à la réciproque du critère de Forni pour la positivité des exposants de Lyapunov du cocycle de Kontsevich-Zorich*, joint with Vincent Delecroix, **Mathematical Research Letters** vol. 22, p. 1667-1678 (2015).
- A coding-free simplicity criterion for the Lyapunov exponents of Teichmüller curves*, joint with Alex Eskin, **Geometriae Dedicata**, vol. 179, n. 1, 45-67 (2015).
- Hodge-Teichmüller planes and finiteness results for Teichmüller curves*, joint with Alex Wright, **Duke Mathematical Journal**, vol. 164, 1041-1077 (2015).
- Some examples of isotropic $SL(2, R)$ -invariant subbundles of the Hodge bundle*, joint with Gabriela Weitze-Schmithüsen, **International Mathematics Research Notices**, vol. 2015, n. 18, 8657-8679 (2015).
- A criterion for the simplicity of the Lyapunov spectrum of square-tiled surfaces*, joint with Martin Möller and Jean-Christophe Yoccoz, **Inventiones mathematicae**, vol. 202, n. 1, 333-425 (2015).
- Typical symplectic locally constant cocycles over certain shifts of countable type have simple Lyapunov spectra*, joint with Michel Cambrinha, **Portugaliae Mathematica**, vol. 73, n. 3, 171-176 (2016).
- Rates of mixing for the Weil-Petersson geodesic flow I: No rapid mixing in non-exceptional moduli spaces*, joint with Keith Burns, Howard Masur and Amie Wilkinson, **Advances in Mathematics**, vol. 306, p. 589-602 (2017).
- Rates of mixing for the Weil-Petersson geodesic flow: exponential mixing in exceptional moduli spaces*, joint with Keith Burns, Howard Masur and Amie Wilkinson, **Geometric and Functional Analysis**, vol. 27, p. 240-288 (2017).
- Positivity of the top Lyapunov exponent for cocycles on semisimple Lie groups over hyperbolic bases*, joint with Mário Bessa, Jairo Bochi, Michel Cambrinha, Paulo Varandas and Disheng Xu, **Bulletin Brazilian Mathematical Society**, vol. 49, no. 1, 73-87 (2018).
- An estimate on the Hausdorff dimension of stable sets of non-uniformly hyperbolic horseshoes*, joint with Jacob Palis, **Discrete Contin. Dyn. Syst.**, vol. 38, 431-448 (2018).
- Quaternionic covers and monodromy of the Kontsevich-Zorich cocycle in orthogonal groups*, joint with Giovanni Forni and Simion Filip, **Journal of the European Mathematical Society**, vol. 20, 165-198 (2018).
- Non-uniformly hyperbolic horseshoes in the standard family*, joint with Carlos Gustavo Moreira and Jacob Palis, **C. R. Acad. Sc.**, vol. 356, 146-149 (2018).

- Zorich conjecture for hyperelliptic Rauzy-Veech groups*, joint with Artur Avila and Jean-Christophe Yoccoz, **Math. Annalen** vol. 370, 785-809 (2018).
- Symbolic dynamics for non-uniformly hyperbolic surface maps with discontinuities*, joint with Yuri Lima, **Annales de l'ENS**, vol. 51, 1-38 (2018).
- Continuity of Hausdorff dimension across generic dynamical Lagrange and Markov spectra*, joint with Aline Cerqueira and Carlos Gustavo Moreira, **Journal of Modern Dynamics**, vol. 12, 151-174 (2018).
- $HD(M \setminus L) > 0.353$, joint with Carlos Gustavo Moreira, to appear in **Acta Arithmetica** (2018).
- Appendix *On special Lagrangian fibrations in generic twistor families of K3 surfaces*, joint with Nicolas Bergeron, to the article “Counting Special Lagrangian Fibrations in Twistor Families of K3 surfaces” of Simion Filip, to appear in **Annales de l'ENS** (2018).
- Markov spectrum near Freiman’s isolated points in $M \setminus L$* , joint with Carlos Gustavo Moreira, **Journal of Number Theory**, vol. 194, 390-408 (2019).
- The Kontsevich-Zorich cocycle over Veech-McMullen family of symmetric translation surfaces*, joint with Artur Avila and Jean-Christophe Yoccoz, **Journal of Modern Dynamics**, Veech special volume (2019).
- Semisimplicity of the Lyapunov spectrum for irreducible cocycles*, joint with Alex Eskin, to appear in **Israel J. Math.** (2018).
- Cohomological equation and local conjugacy class of Diophantine interval exchange maps*, joint with Giovanni Forni and Stefano Marmi, to appear in **Proc. Amer. Math. Soc.** (2019).
- An origami of genus 3 with arithmetic Kontsevich-Zorich monodromy*, joint with Pascal Hubert, to appear in **Math. Proc. Cambridge Philos. Soc.** (2019).

BOOKS

- Aspectos ergódicos da teoria dos números* (Ergodic aspects of Number Theory), joint with A. Arbieto and Carlos Gustavo Moreira, **Publicações Matemáticas do IMPA - 26º Colóquio Brasileiro de Matemática** (2007).
- The remarkable effectiveness of Ergodic Theory in Number Theory, Parts I and II*, (Part I together with A. Arbieto and Carlos Gustavo Moreira), **Ensaio Matemáticos** vol. 17, p. 1-106 (2009).
- Dynamical Aspects of Teichmüller Theory*, **Atlantis Studies in Dynamical Systems**, vol. 7, Springer International Publishing (2018).

EXPOSITORY ARTICLES

- Disquisitiones Mathematicae* (<https://matheuscms.wordpress.com/>): mathematical blog.
- C^1 *density of hyperbolicity for Benedicks-Carleson toy models*, joint with Carlos Gustavo Moreira and Enrique Pujals, **Oberwolfach Reports**, vol. 6, p. 1819-1823 (2009).

- On the neutral Oseledets bundle of Kontsevich-Zorich cocycle over certain cyclic covers*, joint with Giovanni Forni and Anton Zorich, **Oberwolfach Reports**, vol. 8, p. 1361-1427 (2011).
- Le flot géodésique de Teichmüller et la géométrie du fibré de Hodge*, **Actes du Séminaire de Théorie Spectrale et Géométrie du Institut Fourier à Grenoble**, vol. 29, p. 73-95 (2010-2011).
- Fractal geometry of non-uniformly hyperbolic horseshoes*, **Proceedings of the Ergodic Theory Workshops at University of North Carolina at Chapel Hill, 2011-2012**, Ed. by Idris Assani, p. 197-240 (2013).
- A criterium for the simplicity of Lyapunov exponents of origamis*, joint with Martin Möller and Jean-Christophe Yoccoz, **Oberwolfach Reports**, vol. 10, p. 19752033 (2013).
- Introduction to Teichmüller theory and its applications to dynamics of interval exchange transformations, flows on surfaces and billiards*, joint with Giovanni Forni, **Journal of Modern Dynamics**, vol. 8, no. 3/4, p. 271-436 (2014).
- Lecture notes on the dynamics of the Weil-Petersson flow*, **CIRM Jean-Morlet Chair Subseries**, B. Hasselblatt ed., Lect. Notes Math. 2164, 209-291, Springer Verlag (2017).
- Variations of Hodge structures, Lyapunov exponents and Kontsevich's formula*, appendix to the book *Gauss-Manin Connection in Disguise (Calabi-Yau Modular Forms)* by Hossein Movasati, **Surveys of Modern Mathematics**, vol. 13 (2017).
- Les blogs: un outil dynamique de communication en mathématiques*, **Gazette des Mathématiciens**, vol. 148, p. 46-50 (2016).
- The Lagrange and Markov spectra from the dynamical point of view*, **CIRM Jean-Morlet Chair Subseries**, S. Ferenczi, J. Kulaga-Przymus, M. Lemanczyk (eds), Lect. Notes Math., vol 2213, 259–291, Springer, Cham (2018).

January 15, 2019.

Carlos Matheus Silva Santos