

Brice Loustau

Postdoctoral associate at TU Darmstadt, Germany

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Research Interests

Geometric structures, classical and higher Teichmüller-Thurston theory, character varieties, complex projective structures, symplectic geometry of moduli spaces, hyper-Kähler structures, minimal surfaces, harmonic maps, Higgs bundles, discrete differential geometry.

Academic positions

- 2018 – present** Postdoctoral Associate at TU Darmstadt, Germany.
- 2015 – 2018** Postdoctoral Associate at Rutgers University - Newark, New Jersey, USA.
- 2014 – 2015** Visiting Research Associate at IMPA, Rio de Janeiro, Brazil.
- 2011 – 2014** Postdoctoral Associate at Université Paris-Sud XI Orsay. ERC *HighTeich* program of François Labourie.

Education

- 2008 – 2011** Ph.D., Université de Toulouse 3. Mention Très Honorable (highest honors).
Ph.D. Thesis: The symplectic geometry of the deformation space of complex projective structures on a surface.
Advisor: Jean-Marc Schlenker.
Ph.D. Committee: G. Besson (president), S. Kerckhoff (referee), F. Bonahon (referee), J.-M. Schlenker (advisor), C. Lecuire, A. Papadopoulos, S. Tan.
- 2007 – 2008** Masters in Pure Mathematics, Université de Toulouse 3. Mention Très Bien (highest honors).
- 2007** Agrégation de Mathématiques. Rank: 28/2801.
- 2004 – 2006** École Normale Supérieure de Cachan - antenne de Bretagne.
- 2002 – 2004** Classes Préparatoires, M. Montaigne, Bordeaux (MPSI, MP*).
- 2002** Baccalauréat à Option Internationale, série S. Mention Très Bien (highest honors).

Publications

1. The symplectic geometry of the deformation space of complex projective structures.
Geometry & Topology 19 (2015), no. 3, 1737–1775.
2. Minimal surfaces and symplectic structures of moduli spaces.
Geometriae Dedicata 175 (2015), 309–322.
3. Bi-Lagrangian structures and Teichmüller theory (joint with [Andy Sanders](#)).
Submitted. Preprint: <https://arxiv.org/abs/1708.09145>
4. Computing discrete equivariant harmonic maps (with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).
Submitted. Preprint: <https://arxiv.org/abs/1810.11932>
5. Computing harmonic maps between Riemannian manifolds (with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).
Submitted. Preprint:
6. Harmonic maps from Kähler manifolds.
Submitted. Preprint:

Works in preparation

7. Complex geometry of the universal moduli space of Higgs bundles (with [Andy Sanders](#) and [Nicolas Tholozan](#)).
We study the complex, Kähler and hyper-Kähler geometry of the universal moduli space of Higgs bundles over Teichmüller space.
8. Hyper-Kähler geometry of the Taubes moduli space (with [Francesco Bonsante](#), [Andy Sanders](#), and [Andrea Seppi](#)).
We introduce a mixed signature hyper-Kähler metric on the Taubes moduli space, extending the hyper-Kähler metric of Donaldson off almost-Fuchsian space.
9. Symplectic geometry of Wick rotations (with Carlos Scarinci).
We study the symplectic properties of Wick rotations between moduli spaces of Einstein 3-manifolds in relation to bi-Lagrangian structures.
10. Discrete Bochner formula on Riemannian manifolds (with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).
We establish a discrete Bochner formula for functions on a weighted triangulation taking values in Riemannian manifold.

Notes

Available on <https://www.brice.loustau.eu/research.html#Notes>

1. Higgs bundles and Hitchin components.
Notes for the workshop *Higher Teichmüller-Thurston spaces* at Orsay, France, Fall 2012.
2. Minimal surfaces and quasi-Fuchsian structures.
Notes for the NSF workshop *Higgs bundles and harmonic maps* in Asheville, NC, USA, January 2015.
3. Hyperbolic geometry.
Lecture notes for a graduate course taught at Rutgers University, Fall 2017.
4. Riemann surfaces.
Lecture notes for a Masters course at TU Darmstadt, Winter 2018-2019.
5. Harmonic maps from Kähler manifolds.
Notes for the workshop *Harmonic maps and rigidity* in Sisteron, France, April 2019.

Mathematical software development

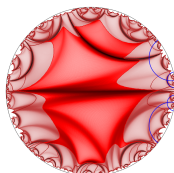


Circle Packings (2012-present)

Computes and shows circle packings and Riemann conformal mappings.

(with Benjamin Beeker)

<https://www.brice.loustau.eu/circlepackingsen.html>



Harmony (2014-present)

(with Jonah Gaster)

Computes and shows equivariant harmonic maps.

<https://www.brice.loustau.eu/software.html#harmony>

Service

Organization of conferences, seminars and workshops

- > Co-organizer of the Workshop *Quantization of moduli spaces* at Sisteron, France, April 2020.
- > Organizer of the *Mathematics Colloquium* at Rutgers University - Newark, 2015-2016 and 2017-2018.
- > Co-organizer of the NSF GEAR Workshop [Analytic Aspects of Higher Teichmüller Theory](#) at Rutgers University - Newark, September 2016. NSF Funding received through GEAR: \$25,000.
- > Co-organizer of the *Mathematics Colloquium* at Rutgers University - Newark, 2016-2017.
- > Co-organizer of the *Teichmüller Theory seminar* at Rutgers University - Newark, 2015-2016, 2016-2017 and 2017-2018.
- > Co-organizer of the *Parabolic complex projective structures* workshop at IMPA, Rio de Janeiro, 2014.
- > Organizer of the *Geometry and Structures* workshop at Université Paris XI, 2013.
- > Co-organizer of the *Higher Teichmüller theory* workshop at Université Paris XI, 2012.

Referee for mathematics journals

- > Referee for *Forum Mathematicum*, 2019.
- > Referee for *European Mathematical Society Surveys*, 2018.
- > Referee for *Annales Scientifiques de l'École Normale Supérieure*, 2018.
- > Referee for *Geometriae Dedicata*, 2017.
- > Referee for *Inventiones Mathematicae*, 2016.
- > Referee for *Geometry & Topology*, 2015.
- > Referee for *Journal of Symplectic Geometry*, 2015.
- > Referee for *Geometry & Topology*, 2013.

Outreach

- > Interview for the magazine *Science & Vie* (#1 science magazine in France) for the article *On ne saura jamais si nous vivons à l'extérieur ou à l'intérieur de la Terre*, July 2016.

Invited talks

Conferences

- > *Computing equivariant harmonic maps*. Higher-Teichmüller theory and geometric structures, scientific meeting. Pavia, Italy, June 2019.
- > *Harmonic maps and Kähler geometry*. Harmonic maps and rigidity, *Projet Jeunes Géomètres* workshop. Sisteron, France, April 2019.
- > *Computing discrete equivariant harmonic maps*. Geometry and Approximation. AG seminar retreat, Höchst, Germany, February 2019.
- > *Bi-Lagrangian structures and Teichmüller theory*. Teichmüller Theory and its Connections to Geometry, Topology and Dynamics. Thematic Program, Fields Institute, University of Toronto, August 2018.
- > *Relative character varieties and their symplectic structure*. Parabolic Higgs bundles and relative character varieties, NSF GEAR Workshop. Palm Springs, California, February 2018.
- > *Computing discrete equivariant harmonic maps*. Analytic Aspects of Higher Teichmüller Theory, NSF GEAR Workshop. Rutgers University - Newark, September 2016.
- > *Harmonic maps*. Workshop on $Sp(4, \mathbb{R})$ Anosov representations, NSF GEAR Network. Granby, Colorado, January 2016.
- > *Minimal surfaces in hyperbolic 3-manifolds and deformation spaces*. AMS Sectional Meeting. Rutgers University, New Brunswick, November 2015.
- > *Computing equivariant harmonic maps*. Higher Teichmüller theory and Higgs bundles: interactions and new trends. Hengstberger Symposium, European Research Council. University of Heidelberg, November 2015.
- > *Minimal surfaces in \mathbb{H}^3 and quasi-Fuchsian representations*. Higgs Bundles and Harmonic Maps Workshop, NSF GEAR Network. Asheville, USA, January 2015.
- > *Geometric structures and character varieties*. Journées nancéiennes de géométrie. Département de mathématiques de Nancy, Université de Lorraine, January 2013.
- > *The hyperkähler geometry of the deformation space of complex projective structures on a surface*. NSF GEAR Retreat. University of Illinois at Urbana-Champaign, USA, August 2012.
- > *Minimal surfaces in almost-Fuchsian manifolds and symplectic structures*. Senior seminar, Geometry and analysis of surface group representations. Institut Henri Poincaré, Paris, March 2012.
- > *Symplectic geometry of deformation spaces*. Geometry, Topology and Dynamics of Character Varieties. Tokyo Institute of Technology and NSF, National University of Singapore, 18 June- 15 August 2010.

Seminars and Colloquia

- > *Computing harmonic maps between Riemannian manifolds*.
 - Geometry seminar, National University of Singapore, November 2019.
- > *Computing equivariant harmonic maps*.
 - Séminaire HORUS, Université de Strasbourg, September 2019.
 - Geometry seminar, Stanford University, June 2019.
 - Geometry seminar, Heidelberg University, December 2018.
- > *Bi-Lagrangian structures and Teichmüller theory*.
 - Geometry and discrete groups seminar, IHES (Paris), June 2018.
 - Complex analysis and dynamics seminar, CUNY graduate center, May 2018.
 - Geometry seminar, McGill University, Canada, April 2018.
 - Colloquium, Korea Advanced Institute of Science and Technology, April 2018.

- Colloquium, Minnesota State University at Mankato, March 2018.
- Symplectic geometry seminar, Stony Brook University, February 2018.
- Geometry seminar, University of Texas at Austin, November 2017.
- Geometry seminar, University of Virginia, September 2016.
- > *Computing discrete equivariant harmonic maps.*
 - Geometry seminar, Korea Advanced Institute of Science and Technology, April 2018.
 - Geometry seminar, Minnesota State University at Mankato, March 2018.
 - Geometry and dynamics seminar, Université de Paris 7, March 2017.
 - Geometry and dynamics seminar, Université de Lille 1, March 2017.
 - Topology/Geometry seminar, Rutgers University - New Brunswick, January 2017.
 - Analysis seminar, Fordham University, December 2016.
- > *Introduction to Teichmüller theory.* Graduate students seminar, Rutgers University - Newark, November 2016.
- > *Generalized Weil-Petersson metrics on character varieties.* Hyperbolic geometry seminar, City University of New York, November 2016.
- > *(Hyper-)Kähler geometry of character varieties.* Geometry seminar, University of Luxembourg, May 2016.
- > *Hyperkähler geometry of character varieties.*
 - Geometry and Dynamics/ GEAR seminar, University of Illinois at Urbana-Champaign, April 2016.
 - Complex Analysis and Geometry seminar, Université de Paris 7, March 2016.
 - Geometry and Topology seminar, Université de Grenoble 1, March 2016
 - Geometry and Topology seminar, Université de Nice Sophia Antipolis, March 2016
 - Complex Analysis and Geometry seminar, Université de Paris 6, March 2016.
- > *Complex Bi-Lagrangian structures.*
 - Geometry and Topology seminar, University of Maryland, February 2016.
 - Geometry and Topology seminar, Boston College, February 2016.
 - Mathematics Colloquium, Rutgers University - Newark, December 2015.
- > *Computing equivariant harmonic maps.* Teichmüller Theory seminar, Rutgers University - Newark, September 2015.
- > *Minimal surfaces and quasi-Fuchsian structures.* Geometry seminar, UFRJ, Rio de Janeiro, June 2015.
- > *Bi-Lagrangian and hyperkähler structures.*
 - Geometry seminar, University of Luxembourg, December 2014.
 - Geometry seminar, Université de Strasbourg, December 2014.
 - Geometry seminar, Université de Lorraine, December 2014.
 - Geometry seminar, Université de Rennes 1, December 2014.
 - Geometry seminar, Université de Bordeaux 1, December 2014.
- > *Introduction to Higgs bundles.* Postdoctoral seminar, Université Paris-Sud XI, October 2013.
- > *Representations of surface groups and Higgs bundles.* Graduate Students seminar, University of Illinois at Chicago, June 2013.
- > *Circle packings and Riemann mappings.* Geometry seminar, Université d'Avignon, May 2013.
- > *Complex projective structures and the $SL(2, \mathbb{C})$ -character variety.* Topology and Dynamics seminar, Université Paris-Sud XI, December 2012.
- > *Higgs bundles and Hitchin components.* Postdoctoral seminar, Université Paris-Sud XI, November 2012.
- > *La géométrie symplectique des structures projectives complexes.* Geometry and Spectral Theory seminar, Université de Grenoble 1, June 2011.
- > *Complex projective structures.* Thematic Workshop, Université de Toulouse III, October 2010.
- > *Géométrie non euclidienne.* Graduate Students seminar, Université de Toulouse III, September 2010.

Teaching

2019 – 2020	Hyperbolic Geometry. TU Darmstadt. Masters. Service: ~90 hours.
2018 – 2019	Riemann Surfaces, General Relativity. TU Darmstadt. Masters. Service: ~90 hours.
2017 – 2018	Abstract Algebra, Discrete Structures, Calculus III. Rutgers University - Newark. Undergraduate. Service: ~153 hours.
2016 – 2017	Complex analysis, Hyperbolic geometry, Calculus III. Rutgers University - Newark. Undergraduate and Graduate. Service: ~153 hours.
2015 – 2016	Elementary Differential Equations x2, Calculus III, Discrete structures, Foundations of Modern Mathematics. Rutgers University - Newark. Undergraduate. Service: ~215 hours.
2011 – 2014	Plane Geometry, Calculus, Linear Algebra, Complex Analysis. Université Paris-Sud XI. Undergraduate (L1, L2, L3). Service: 64 hours/year x3 years.
2008 – 2011	Mathematics for Engineering, Mathematics for Biology, Calculus, Elementary Differential Equations, Linear Algebra, Differential Geometry, Differential Calculus. Université de Toulouse III. Undergraduate (L1, L2, L3). Service: 64 hours/year x3 years.
2006 – 2011	Oral examinations in <i>classes préparatoires</i> . Lycée Basch, Rennes (service: ~30 hours) and Lycée Fermat, Toulouse (service: ~100 hours/year x3 years).
2006	Mathematics in lycée Chateaubriand (high school), Rennes. 2nde and Terminale S. Service: ~60 hours.

Student research supervising

Summer 2019	Darja Zierau: Master thesis at TU Darmstadt, Germany. <i>Thesis title: Cross-ratios of torsion points on elliptic curves.</i>
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Skills

Languages	French (native speaker), English (bilingual), Spanish (conversational), Portuguese (conversational), German (conversational).
Computer science	Development in C++/Qt. Web design (HTML, CSS, Javascript, PHP). Programming in Python, Matlab, Julia, Pascal, Maple, Mathematica, Octave. Advanced user of \LaTeX , GNU/Linux, desktop tools. User and advocate of <i>libre software</i> .

References

- > Ara Basmajian, Professor, CUNY Graduate Center. ABasmajian@gc.cuny.edu
- > Francis Bonahon, Professor, University of Southern California. fbonahon@math.usc.edu
- > David Dumas, Professor, University of Illinois at Chicago. david@dumas.io
- > Jane Gilman, Professor, Rutgers University. gilman@rutgers.edu
(Reference for both teaching and research)
- > William Goldman, Professor, University of Maryland. wmg@math.umd.edu
- > Karsten Grosse-Brauckmann, Professor, TU Darmstadt. kgb@mathematik.tu-darmstadt.de
(Reference for teaching and research)
- > Dominique Hulin, Maître de conférences, Université Paris-Sud XI. dominique.hulin@math.u-psud.fr
(Reference for both teaching)
- > Steven Kerckhoff, Professor, Stanford University. spk@math.stanford.edu
- > François Labourie, Professeur, Université de Nice. francois.labourie@math.unice.fr
- > John Loftin, Professor, Rutgers University. loftin@newark.rutgers.edu
(Reference for teaching)
- > Jean-Marc Schlenker, Professeur, Université de Luxembourg. jean-marc.schlenker@uni.lu
(Ph.D. advisor)

Details & Contact

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Citizenship: French, married to U.S. citizen

Contact

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