

# Brice Loustau

Postdoctoral associate at TU Darmstadt, Germany

Web page: <https://www.brice.loustau.eu/>

E-mail: [brice@loustau.eu](mailto:brice@loustau.eu)

## 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, computational 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 twisted harmonic maps (joint with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).  
*Submitted*. Preprint: <https://arxiv.org/abs/1810.11932>
5. Computing twisted harmonic maps (joint with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).  
*In preparation*. This upcoming paper produces a constructive proof of Corlette’s theorem on the existence of equivariant harmonic maps by using successive triangulations of the surface and a discrete heat flow.
6. Weighted graphs on Riemannian manifolds (joint with [Jonah Gaster](#) and [Léonard Monsaingeon](#)).  
*In preparation*. This upcoming paper discusses choices of systems of weights for graphs embedded on Riemannian manifolds. In particular we define a discrete Laplacian approximating the tension field and compute harmonic maps with values in another Riemannian manifold.
7. Hyperkähler geometry of character varieties (joint with [Andy Sanders](#)).  
*In preparation*. This upcoming paper studies a generalization due to A. Sanders of the Kähler structure of Teichmüller space to an open set of the character variety  $X(S, G)$ , where  $S$  is a closed surface and  $G$  is a semisimple Lie group.

## Notes

---

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

1. Higgs bundles and Hitchin components.  
Notes written for the workshop *Higher Teichmüller-Thurston spaces* in Université Paris-Sud XI, France, in 2012.
2. Minimal surfaces and quasi-Fuchsian structures.  
Notes written for the NSF workshop *Higgs bundles and harmonic maps* in Asheville, NC in 2015.
3. Hyperbolic geometry.  
Lecture notes written for a graduate course taught at Rutgers University in 2017.
4. Riemann surfaces.  
Lecture notes written for a graduate course taught at TU Darmstadt in 2018-2019.

## Mathematical software development

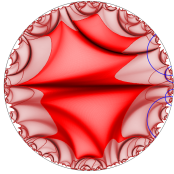
---



### Circle Packings (2012-present)

Computes and shows circle packings and Riemann conformal mappings.

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



### Harmony (2014-present)

Computes and shows equivariant harmonic maps.

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

## Service

---

### Organization of conferences, seminars and workshops

- > 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

- > *TBA*. 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 twisted harmonic maps I*. 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 discrete equivariant harmonic maps*.
  - 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 twisted 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

---

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

## Skills

---

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

## References

---

- > Ara Basmajian, Professor, CUNY Graduate Center. [ABasmajian@gc.cuny.edu](mailto:ABasmajian@gc.cuny.edu)
- > Francis Bonahon, Professor, University of Southern California. [fbonahon@math.usc.edu](mailto:fbonahon@math.usc.edu)
- > David Dumas, Professor, University of Illinois at Chicago. [david@dumas.io](mailto:david@dumas.io)
- > Jane Gilman, Professor, Rutgers University. [gilman@rutgers.edu](mailto:gilman@rutgers.edu)  
(Reference for teaching and research)
- > William Goldman, Professor, University of Maryland. [wmg@math.umd.edu](mailto:wmg@math.umd.edu)
- > Dominique Hulin, Maître de conférences, Université Paris-Sud XI. [dominique.hulin@math.u-psud.fr](mailto:dominique.hulin@math.u-psud.fr)  
(Reference for teaching)
- > Steven Kerckhoff, Professor, Stanford University. [spk@math.stanford.edu](mailto:spk@math.stanford.edu)
- > François Labourie, Professeur, Université de Nice. [francois.labourie@math.unice.fr](mailto:francois.labourie@math.unice.fr)

- > John Loftin, Professor, Rutgers University. [loftin@newark.rutgers.edu](mailto:loftin@newark.rutgers.edu)  
(Reference for teaching)
- > Jean-Marc Schlenker, Professeur, Université de Luxembourg. [jean-marc.schlenker@uni.lu](mailto:jean-marc.schlenker@uni.lu)  
(Ph.D. advisor)

## Details & Contact

---

Date of birth: 5 December 1984

Citizenship: French

### Contact

Address (USA): Brice Loustau c/o Benjamin Velez  
54 Ferry Street  
Newark - NJ 07105, USA

Address (France): 53 allée du Rouquet, FRANCE  
33610 Cestas

Phone (USA): +1 305 984 1372

Phone (France): +33 6 32 46 90 78

E-mail: [brice@loustau.eu](mailto:brice@loustau.eu)

Web page: <https://www.brice.loustau.eu/>

*Last updated: March 3, 2019*