

Curriculum Vitae

Gaëtan Borot

French.

Born in St-Wendel (Germany), June 14th, 1986.

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Studies

- 2011-2013** Postdoctoral position, at the Department of Mathematics, University of Geneva, in the group of Stanislav Smirnov.
- 2008-2011** PhD thesis in Theoretical Physics, at the IPhT, CEA Saclay, under the supervision of Bertrand Eynard.
Some problems in enumerative geometry, random matrices, integrability, studied via the geometry of Riemann surfaces
Obtained from Université d'Orsay, June 2011, mention très honorable.
- 2005-2009** Studies at ENS Paris.
◇ 07/08 Master degree (M2) in Theoretical Physics. Rank: 1st.
◇ Spring 07 Internship at MPI für Gravitationsphysik (Potsdam).
◇ 06/07 Master degree (M1) in Physics.
◇ Fall 06 Course taken on Riemannian Geometry in Paris VII.
◇ 05-06 Licence degree (L3) in Physics.
L3-M1 courses taken at the Department of Mathematics.
- 2003-2005** Classes préparatoires aux Grandes Écoles, MPSI and MP*
Lycée Blaise Pascal, Clermont-Ferrand.

Other skills

- Languages** English and German, read and spoken (between B2 and C1).
- Computer skills** Office softwares, Windows, LATEX, LABVIEW programming, Mathematica, Maple, basics of HTML.

Publications

- 1 *A matrix model for simple Hurwitz numbers, and topological recursion*
with B. Eynard, M. Mulase, B. Safnuk.
J. Geom. Phys. **61**, 26, 522-540 (2010), [math-ph/0906.1206](#)
- 2 *Enumeration of maps with self avoiding loops and the $O(n)$ model on random lattices of all topologies*
with B. Eynard.
J. Stat. Mech. P01010 (2011), [math-ph/0910.5696](#)
- 3 *Large deviations of the maximal eigenvalue of random matrices*
with B. Eynard, S.N. Majumdar and C. Nadal.
J. Stat. Mech. P11024 (2011), [math-ph/1009.1945](#).
- 4 *Tracy-Widom GUE law and symplectic invariants*
with B. Eynard.
[nlin.SI/1011.1418](#) (2010), preprint.
- 5 *A recursive approach to the $O(n)$ model on random maps via nested loops*
with J. Bouttier and E. Guitter.
J. Phys. A: Math Theor, **45** (2012), [math-ph/1106.0153](#)
- 6 *Asymptotic expansion of β matrix models in the one-cut regime*
with A. Guionnet.
to appear in Comm. Math. Phys. (2012), [math-PR/1107.1167](#).
- 7 *Geometry of spectral curves and all order dispersive integrable system*
with B. Eynard.
to appear in SIGMA (2013), [math-ph/1110.4936](#).
- 8 *Purity distribution for random Bures mixed states*
with C. Nadal.
J. Phys A: Math Theor, **45** (2012), [cond.mat-stat.mech/1110.3838](#)
- 9 *Right tail asymptotic expansion of Tracy-Widom beta laws*
with C. Nadal.
Random matrices: Theory Appl. (2012), [math-ph/1111.2761](#)
- 10 *More on the $O(n)$ model on random maps via nested loops: loops with bending energy*
with J. Bouttier and E. Guitter.
J. Phys. A: Math. Theor. **45** (2012) 275206 , [math-ph/1202.5521](#)
- 11 *All-order asymptotics of hyperbolic knot invariants from non-perturbative topological recursion of A -polynomials*
with B. Eynard, submitted.
[math-ph/1205.2261](#) (2012).

- 12 *Loop models on random maps via nested loops: case of domain symmetry breaking and application to the Potts model*
with J. Bouttier and E. Guitter.
to appear in J. Phys. A, special issue (2012), [math-ph/1207.4878](#).
- 13 *Resolvent methods for steady premixed flame shapes governed by the Zhdanov-Trubnikov equation*
with B. Denet and G. Joulin.
J. Stat. Mech. (2012), P10023, [cond-mat.stat-mech/1207.5416](#).
- 14 *$d \times d$ Lax pairs and loop equations*
with M.C. Bergère and B. Eynard, in preparation.
- 15 *Asymptotic expansion of β matrix models in the multi-cut regime*
with A. Guionnet, in preparation.
- 16 *Generalized topological recursion and applications*
with B. Eynard and N. Orantin, in preparation.

Proceedings

- P1 *Loop equations and spectral curves*, Mathematische Arbeitstagung 2011, Max-Planck-Institut für Mathematik.
- P2 *Asymptotics of invariants of 3-manifolds and topological recursion*, Oberwolfach Reports, workshop "Low dimensional topology and number theory", August 2012.

Talks

- Poster on the results of [1] at the **ENRAGE Network Meeting**, MPI Dresden, May 2009.
- Joint presentation with the co-authors of the results of [1] at **AIM Workshop**, Palo Alto, June 2009.
- Seminar for the **Semester on matrix models and geometry**, IST Lisbon, October 2009: "Simple Hurwitz numbers and a proposition of Bouchard and Mariño".
- Poster at the **Vth Brunel workshop on random matrix theory**, London, December 2009: "The $O(n)$ model on random lattices of all topologies"
- Young scientists seminar **SinJe, LPT Orsay**, January 2010: "Algebraic geometry applied to enumeration of self-avoiding loops".
- Mathematical physics seminar, **SISSA**, Trieste, April 2010: "Construction of a dispersive integrable system via geometry of algebraic curves".

- Poster at the **satellite conference of StatPhys10, Exactly solvable models in statistical physics**, University of Queensland, July 2010: "The $O(n)$ model on random lattices of all topologies".
- Talk at the **conference "Random matrix theory and its applications"**, MSRI, Berkeley, September 2010: "Asymptotics of Tracy-Widom beta law".
- Talk at the **Students Conference on Strings, Gravity and Cosmology, IHP**, Paris, November 2010: "Introduction to the BKMP conjecture".
- Strings seminar, **Bethe Center for Theoretical Physics, Bonn University**, December 2010 : "Topological strings and matrix models".
- Joint seminar with C. Nadal at the **Spring school "Vicious walkers and random matrices"**, **les Houches**, May 2010: "All order left-tail asymptotics of Tracy-Widom beta law".
- Chosen talk at the **Arbeitstagung, MPI Bonn**, June 2011: "Loop equations and spectral curves".
- Functional analysis seminar, **UCLA Maths Department**, August 2011: "Analytic combinatorics: counting maps with self-avoiding loops".
- Mathematical physics seminar, **Concordia University, Montréal**, October 2011: "Integrability and geometry of spectral curves".
- Informal presentation at the workshop **"New recursion formulae . . ."** in **Banff, BIRS**, October 2011: "A candidate for a dispersive solution to Hirota equations".
- Probability seminar, **Zürich Universität**, February 2012: "All order finite size corrections in Coulomb gases".
- Talk at the **Winter school "Random matrices and applications"**, **les Houches**, March 2012: "Integrable systems, loop equations and topological recursion".
- Talk at the **workshop in mathematical physics organized by the Maths Department of Geneva, les Diablerets**, March 2012: "Map enumeration problems in the $O(n)$ model and the Potts model".
- Invited talk at the **workshop "Integrability in topological field theory"**, **HCM, Bonn**, April 2012: "Topological recursion, theta functions, and perturbative knot invariants".
- Seminar at **UNIGE**, April 2012: "A conjecture for the all-order asymptotics of the colored Jones polynomial of hyperbolic knots".
- Strings seminar at **IST Lisbon**, May 2012: "Matrix models, knot invariants and non-perturbative topological recursion".
- Invited talk at the **workshop "Contemporary Ways of Integrability"**, **Lisbon University**, May 2012: "Integrability, non-perturbative topological recursion and an application to knot invariants".
- Invited talk at the **workshop in honor of Sasha Its, IHP**, May 2012: "Integrability, topological recursion for A-spectral curves, and knot invariants".

- Talk at the **3rd workshop on "Combinatorics of moduli spaces, cluster algebras, knots, and topological recursion"**, Moscow, May 2012: "Non-perturbative topological recursion and application to knot invariants".
- Informal Mathematical Physics seminar, **SISSA**, Trieste, July 2012: "Asymptotics of wave functions and application to knot theory".
- Talk at the **workshop "Low dimensional topology and number theory"**, **Oberwolfach**, August 2012: "Asymptotics of the colored Jones polynomial, topological recursion and theta functions".
- Number theory seminar, **MPI Bonn**, September 2012: "Asymptotics of the colored Jones polynomial, topological recursion and theta functions".
- Informal seminar, **LPT ENS, Paris**, October 2012: " $O(n)$ -type singular integral equations and applications".
- Random matrix theory seminar, **Universität Bielefeld**, October 2012: "All order finite size corrections in repulsive particles systems".
- Seminar "Topologies", **Université de Montpellier 2**, November 2012: "Algebraic geometry on character variety and a conjecture on all-order asymptotics of knot invariants".
- Informal seminar, **LPTHE Jussieu, Paris**, December 2012: "Topological expansion in generalized matrix models".
- Invited talk at the **conference "Recursion and integrability"**, **Center for Quantum Geometry of Moduli Spaces, Aarhus**, Denmark, 28th January-1st February 2013.
- Invited talk at the **conference "Quantum topology and hyperbolic geometry"**, **Nha Trang, Vietnam**, 13-17th May 2013.

Other conferences attended

- **Summer school at Beg Rohu**, Quiberon, France, June 16-28th 2008, *Elastic manifolds in random media and extreme values statistics*.
- **Spring school in geometry and quantum topology**, les Diablerets, March 20-25th 2011.
- **The versatility of integrability**, conference in honor of Krichever's 60th birthday, University of Columbia, New York, May 4-7th 2011.
- **Graduate summer school "Cluster algebra and cluster combinatorics"** at MSRI, Berkeley, August 1-12th 2011.
- **Conference GranMa 2011 "Random matrices"**, Paris, IHP October, 3-6th Oct 2011.

- **Conference "Philippe Flajolet and analytic combinatorics"**, Paris, Jussieu, 14-16th December 2012.
- **515. WE-Heraeus-Seminar on "Algebro-geometric methods in fundamental physics"**, Bad Honnef Physikzentrum, September 3rd-7th 2012.
- **Workshop on "Random matrix theory and applications"**, Telecom Paris Tech, October 8th-10th 2012.

Visits

- One month stay at the SISSA, Trieste, in April 2010. Hosts : Boris Dubrovin and Tamara Grava.
- One week stay at the Department of Mathematics and Statistics, Melbourne, in July 2010. Host : Jan de Gier.
- One month stay at MPI Bonn, in July 2011. Host: Don Zagier.
- One week stay at the SISSA, Trieste, in July 2012. Host: Tamara Grava.
- One month stay at MPI Bonn, in September 2012. Host: Don Zagier.
- One week stay at the SISSA, Trieste, in October 2012. Host: Boris Dubrovin and Tamara Grava.
- One week stay at the Theoretical Physics Department, Universität Bielefeld, in October 2012. Host: Gernot Akemann.
- One week stay at IAS, Princeton, in January 2013. Host: Tudor Dimofte.
- Two week stay at MIT, Boston, in January 2013. Host: Alice Guionnet.

Reviewing

Annales Henri Poincaré, SIGMA, Random Matrix Theory and Applications, J. Phys. A: Math. Theor.

Teaching

- **Students training**, in 2007-2008, at the Institut Bossuet (Paris). I gave oral training exams on various physics topics to students in Classes Préparatoires, who are preparing in this way the exams allowing to enter French engineer schools.
- **Teaching**. As a PhD contract employee of Université d'Orsay, I participated to the teaching tasks for the period 2009-2011.
 - ◇ Exercise sessions "Evolutions laws in physics", L1 (Prof: Hagop Sazdjian).
 - ◇ Practical works in "Fiber optics" for students trained to obtain a Bachelor's degree in optics and electronics (Prof: Stéphane Douin).
 - ◇ Oral examinations and tutorials for L2 students preparing exams to enter engineer schools.
- **Scientific popularization**. With other PhD students at the CEA, we welcomed for 4 days three pupils from secondary school (15-17 years old). This week was organized in coordination with the French association "Science Academy", which aim is to promote scientific callings among youths. We gave them talks on modern physics, and they realized a bibliographic project with a poster at the end. In particular, I gave an informal talk on the progressive discovery of new states of matter since the beginning of the nineteenth century, coming along the seek for low temperatures. It was the opportunity for them to see what was the history of ideas and the intrication of the theoretical advances with the technological knowledge.
- **Teaching**. I participate to the teaching tasks at the University of Geneva by running exercise sessions.
 - ◇ Complex analysis I, 2nd year, Fall 2011 (Prof: Anders Karlsson).
 - ◇ Probability and statistics, 2nd year, Fall 2011 (Prof: Hugo Duminil-Copin).
 - ◇ Advanced topics in the theory of manifolds, Fall 2012 (Prof: Paul Turner).
 - ◇ General maths, 1st year, Spring 2013 (Prof: Sylvain Sardy).
 - ◇ Complex analysis II, 2nd year, Spring 2013 (Prof: Ernst Hairer).
- **Scientific popularization**. I participated to "Fête des Sciences" (July 7th 2012), where the Maths Department of the University of Geneva had a spot. The aim was to sensitize people to mathematical questioning, by the presentation of enigmas, posters, or counter-intuitive facts, with running theme "Find the mistake".

Other experiences

- **L3 experimental internship**, in July 2006, at the Centre Lasers Intenses et Applications, Bordeaux, France, under the supervision of Éric Cormier. "Characterization of ultrashort laser pulses". Realization of an experimental setup (non linear mixing of two waves) to measure the duration of a pulse of about 200 ps. Approximative reconstruction of the time signal from interferometric data.
- **M1 internship**, February-July 2007, MPI für Gravitationsphysik, Potsdam, under the supervision of Hermann Nicolai. "Extra dimensions in field theory and dimensional reductions". On a suggestion of Stefan Theisen, I established that the classification by Scherk of flat symmetry groups leading to a stable dimensional reduction of Einstein-Hilbert action via the Scherk-Schwarz mechanism, is complete.
- **M2 experimental internship**, in January-February 2008, at LPS ENS, under the supervision of Étienne Rolley. Random deposition of 10 (or 50) μm large non wetting patches on a silicium substrate (10 et 50 μm). Observation, recording, and statistics of depinnings of a contact line (air-liquid-substrate). Tests of theoretical predictions (in relation with P. Le Doussal et K. Wiese, working at the Laboratoire de Physique Théorique, at ENS) on these statistics, and on the height correlation functions.