

**LAMBOLEY**  
**Jimmy**

Dath of birth : January 15, 1983  
French citizenship

## PROFESSIONAL OCCUPATION

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Since September 2009, I am an assistant professor at the “Université de Paris-Dauphine” in Paris (France). During the year 2013-2014, I am attached to the CNRS (“délégation CNRS”)

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## HIGHER EDUCATION

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2005–2009 **PhD of mathematiques** supervised by Michel PIERRE, at ENS Cachan (Brittany site), in the laboratory IRMAR of the university of Rennes 1,

Subject : *Variations around irregular and optimal shapes.*

PhD defense : December 5<sup>th</sup> 2008, with the following committee : A. Henrot, D. Bucur, P. Freitas, P. Cardaliaguet, F. Gazzola, M. Pierre

2002–2006 Student at **École Normale Supérieure de Cachan**, Brittany site.

2004–2005 **Master’s degree in mathematical research**, University of Rennes 1, analysis and applications, *with honors, rank 1*,  
Laureate of the **Agregation** competitive exam (National exam), *rank 20* (1800 participants, 380 admitted) .

## Research activities

### PHD THESIS

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My PhD takes place in the mathematic field called **shape optimization**. More precisely, we focus on difficulties linked to the writing of optimality conditions, and how to use them. The two main obstacles that have been analysed are the following :

- to deal with shape whose **regularity** is a priori unknown,
- to deal with **strong geometrical constraints**, i.e. which allow very few variations in the writing of optimality (for example the **convexity**).

The results are described in the five publications [1–5], see below.

Since my PhD, I try to enlarge my research interests in three main directions : Convex Geometry, Geometrical Analysis and Regularity of Free boundaries. First I keep in mind some questions from those fields which can be related to calculus of variations and use the tools I have been studying during my PhD, and second I learn about the main questions and tools which are specific to those fields, in order to get new directions of research.

About Convex geometry ([6] and [9]) : the questions of shape optimization among convex bodies is naturally linked to the so-called Brunn-Minkowski inequalities. In some sense, some of my results can be understood as local versions of these inequalities, for various functionals, including geometrical functionals and PDE-energies as well. This also leads to the notion of local indecomposability of sets. The proofs are deeply related to Poincaré-type inequalities, seen as second order optimality conditions for optimality. I also started to focus my research on the famous Mahler conjecture, wondering about the minimizer of the Mahler-volume  $|K||K^\circ|$  among symmetric convex bodies  $K \subset \mathbb{R}^n$ .

About Geometrical Analysis ([11] and [12]) : I start to study the Faber-Krahn profile of a manifold. It is just a replacement of the classical isoperimetric profile, where the first eigenvalue of the Laplace-Beltrami operator (with Dirichlet boundary conditions) replaces the perimeter. Very few results are known, whereas it appears very promising with such a study to find some applications in Differential Geometry and in Spectral Theory as well.

About the regularity of free boundaries ([14]) : we are interested in the so-called “one-phase free boundary” problem. Based on the seminal work of Alt-Caffarelli (1981), we study the behavior of free boundaries when the Dirichlet energy is replaced by a singular one. In particular, this leads to new blow-up solutions. Another generalization I am interested in is the case of Free boundaries in Riemannian manifold. We solve part of the regularity questions in [11].

I also continue to study some other strong constraints in optimization : in [13] we investigate the diameter constraint from an analytical point of view, with optimality conditions and applications of such conditions. Finally, I keep studying the question of regularity in shape optimization, in particular when they are in relation with the previous situations (see [7], [15]).

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## PUBLICATIONS

Every published paper is available on my webpage <http://www.ceremade.dauphine.fr/~lamboley/>

- [1] LAMBOLEY J., PIERRE M., *Structure of shape derivatives around irregular domains and applications*, Journal of Convex Analysis 14 (2007), No. 4, 807–822
- [2] FRAGALÀ I., GAZZOLA F., LAMBOLEY J., PIERRE M., *Counterexamples to Symmetry for Partially Overdetermined Elliptic Problems*, Analysis (Munich) 29 (2009), no. 1, 85–93
- [3] BRIANÇON T., LAMBOLEY J., *Regularity of the optimal shapes for the first eigenvalue with volume and inclusion constraints*, Annales de l’IHP, Analyse non linéaire, **26** (2009), no. 4, 1149–1163
- [4] LAMBOLEY J., NOVRUZI A., *Polygon as optimal shapes with convexity constraint*, SIAM Control and Optimization, **48** (2009/10), no. 5, 3003–3025
- [5] LAMBOLEY J., *About Hölder-regularity of the optimal convex shape for  $\lambda_2$* , Applicable Analysis, **90** (2011), no. 2, 263–278
- [6] BUCUR D., FRAGALÀ I., LAMBOLEY J., *Optimal convex shapes for concave functionals*, ESAIM Control and Optimization, Volume 18, Issue 03, July 2012, pp 693-711
- [7] LAMBOLEY J., NOVRUZI A., PIERRE M. *Regularity and singularities of Optimal convex shapes in the plane*, Archive for Rational Mechanics and Analysis 205, 1 (2012) 311-343
- [8] FRAGALÀ I., GAZZOLA F., LAMBOLEY J. *Sharp bounds for the p-torsion of convex planar domains*, proceedings of the INdAM Workshop “Geometric properties for parabolic and elliptic PDE’s” held in Cortona (Italy) in June 2011

- [9] HARRELL E., HENROT A., LAMBOLEY J. *About local minimizers of the Mahler functional*, preprint
- [10] DAMBRINE M., KATEB D., LAMBOLEY J. *An extremal eigenvalue problem for the Ventcel-Laplace operator*, preprint
- [11] LAMBOLEY J., SICBALDI P., *Existence and regularity of Faber-Krahn minimizers in a Riemannian manifold*, preprint
- [12] LAMBOLEY J., SICBALDI P., *New examples of extremal domains for the first eigenvalue of the Laplace-Beltrami operator in a Riemannian manifold with boundary*, preprint
- [13] A. HENROT, LAMBOLEY J., PRIVAT Y., *Shape optimization under diameter constraint*, work in progress
- [14] LAMBOLEY J., SIRE Y., TEIXEIRA E., *On a degenerate free boundary problem involving an  $A_2$  weight*, work in progress
- [15] LAMBOLEY J., *Regularity of optimal convex shapes with perimeter penalization*, work in progress
- [16] DAMBRINE M., LAMBOLEY J., *Stability in shape optimization*, work in progress

#### TALKS AND CONFERENCES

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- 2014 Invited speaker at the conference “**Isoperimetric Problems between Analysis and Geometry**” in Pisa, in june  
Invited in the “**Free Boundary Problems and Related Topics**” semester in Newton’s institute in Cambridge, in january and may
- 2013 Conference “**New Trends in Shape Optimization**” in Erlangen (Germany), invited speaker in the “pure” session, in september
- 2012 Conference “**Colloque Franco-Roumain of Applied Maths**” in Bucarest, invited speaker in the session “Analysis and Analysis of PDE”, in august  
Conference “**New trends in shape Optimization**” in Pisa, invited speaker, in july  
Conference “**Shape Optimization and Spectral Theory**” at CIRM Luminy, short communication, in may  
Conference “**Picof 2012**” in Palaiseau, short communication, in april  
Seminars : “Séminaire d’Analyse Grenoble-Lyon” (2 hours) and Cergy in february, “Polytechnique-Orsay’s Calculus of Variations seminar” and Milano in april, Marseille in november.
- 2011 Conference “**Workshop on Geometric Analysis**” in Granada, in november  
Seminars : Paris-Dauphine in march (“*About the Spectral gap conjecture*” by A. Andrews and J. Clutterbuck), Ottawa in june, Atlanta in july, Cologne in november, Milano in december.
- 2010 Conference “**CANUM 2010**” in Bordeaux, short communication, in june  
“Workshop on convexity constraint” in Rennes, in november  
Seminar : Napoli in april
- 2009 Seminars : Scuola Normale Superiore di Pisa in march, Orsay and Marseille in april, Milano in june, Paris-Dauphine and Montpellier in october, Amiens and “Workshop on homogeneization” in Paris 6 in november
- 2008 Conference **CVA 2008**, short communication, in september, at Lisboa (Portugal)  
Conference **FBP 2008**, short communication, in june, at Stockholm (Sweden), Title : *Regularity of the boundary of an optimal shape with convexity constraints*  
Seminars : “Rennes-Nantes day” at laboratory Jean Leray and Tour in february, Ottawa in april
- 2007 Conference **SMAI 2007**, short communication, in june, in Praz-sur-Arly (France), Title : *Structure of shape derivatives around irregular sets*  
Seminar : Brest.

## RESEARCH VISITS

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Visit in Universidade Federal do Ceara, Brazil, in september 2013 for a collaboration with E. Teixeira.  
Visit in Atlanta Georgia Tech (US), in july 2011 for a collaboration with E. Harrell.  
Visit in Milano (Italy), in february 2011 for a collaboration with F. Gazzola and I. Fragalà  
Visit in Pisa (Italy), from february to june 2009, invitation of Prof. L. Ambrosio (SNS Pisa) and G. Buttazzo (University of Pisa).  
Visit in Ottawa (Canada), in april 2008, june 2011, and october 2013 for a collaboration with A. Novruzi.

## SCIENTIFIC RESPONSABILITIES

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Member of the PhD defense committee of Loïc Le Treust in june 2013  
ANR Project GAOS 2009-2012  
ANR Project OPTIFORM 2012-2016  
Scientific committee for “Maitre de conférences” positions : Nancy in june 2011 (the position was a “Chaire CNRS”), Dauphine in june 2012.  
Reviewing activity : Journal de l’Ecole Polytechnique, Annales de l’IHP nonlinear analysis, ESAIM COCV, Archivum Mathematicum ; Electronic Journal of Differential Equations ; Optimization Methods and Software  
Organisation of a working group on Calculus of Variations in Paris-Dauphine, since september 2012.

## Teaching activities

## ENSEIGNEMENT

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### Number of hours per year :

2012-2013 : 200h, 2011-2012 : 160h, 2010-2011 : 106h, 2009-2010 : 154h, 2008-2009 : 64h, 2007-2008 : 64h, 2006-2007 : 64h (As a member of CNRS in 2013-2014 (délégation), I had no teaching duties)

- 2011–2014 Member of the Agrégation committee
- 2011–2013 Teaching at Tunis-Dauphine university : responsibility of the main lecture “Differential calculus and Optimization”
- 2009–2013 Teaching at Dauphine’s university :
- 3rd year level (Mathematics and Decision) : Main lecture and exercises session on “Introduction to Fonctionnal Analysis and Fourier Analysis”, Exercises sessions for “Differential calculus and Optimisation”, Exercises sessions for “Differential sytems”.
  - 4th year level (Mathematics of Decision, major in Mathematics) : Exercises session for “Control of Markov Chains”.
  - Lectures and exercises sessions for 1st year student in Economy program.
- 2005–2009 Teaching at the ENS Cachan antenne de Bretagne :
- 3rd year level : Exercises sessions for “Intégration and probabilties”,
  - 4th year students : Complements on “functional analysis”, Complements on “distributions theory”, Exercises session for “Numerical Analysis and PDE”
  - Agrégation : advisor for some “leçon d’agrégation”, Complements of lectures on the “Fourier Tranform”
- 2005–2006 - Oral interrogations in preparatoring schools at Chateaubiand’s high-school, Rennes (35),