



AYUDAS RAMÓN Y CAJAL CONVOCATORIA 2016

Turno de acceso general

Nombre: BALACHEFF , FLORENT
Referencia: RYC-2016-19334
Área Científica: Matemáticas
Correo Electrónico: fbalacheff@yahoo.fr

Título:

Local and global systolic geometry and topology

Resumen de la Memoria:

My research focuses on quantitative topology, with a special attention to systolic geometry and topology.

Systolic geometry and topology involve mainly three ingredients : geometry, topology and dynamical systems. Indeed one of the main purpose of this topic is to study, for a fixed manifold, the existence and the quantification of a geometric inequality called isosystolic inequality. This inequality says roughly that, for a closed manifold endowed with some Riemannian metric, if the fundamental group is big enough, then its volume has to be big too. Here the size of the fundamental group is measured through a quantity called homotopical systole and defined as the shortest length of a non-contractible closed curve. Because in several cases (such as hyperbolic metrics) the homotopical systole coincides with the least period of a periodic orbit of the geodesic flow, techniques from dynamical systems naturally arise in this topic.

Because the volume measures the size of the fundamental class of the manifold, like the homotopical systole measures the size of the fundamental group, the underlying phenomena behind isosystolic inequalities is a subtle interaction between the fundamental group and the fundamental class. To prove and quantify such isosystolic inequalities implies to understand how these topological invariants interact in presence of a metric, and to deeply analyse the topology of the manifold.

The study of interactions between topological invariants measured in presence of a metric is a more general topic called quantitative topology in Riemannian geometry. For instance the study of inequalities involving minmax quantities appearing in geometric measure theory is naturally included into this framework and enlarges this research field.

Albeit quantitative topology lies classically at the crossroad of topology, metric geometry and differential geometry, we recently discover together with collaborators several strong links with contact and also convex geometry. These new connexions have already been very fruitful with new insights in convex geometry, geometry of numbers, contact geometry, and systolic geometry of course. We plan in the future to further investigate these new research directions.

Resumen del Currículum Vitae:

Education:

2012	Habilitation in Mathematics Univ. of Lille, France
2005	PhD in Mathematics Univ. of Montpellier, France
1999 - 2000	Master in Pures Mathematics University of Paris 7, France
1998 - 2001	Student of the Ecole Normale Supérieure Ecole Normale Supérieure de Cachan, France

Professional experience:

Since 2008	Associate Professor (Maître de Conférence) Univ. of Lille, France
2007 - 2008	Postdoctoral Researcher Univ. of Neuchâtel, Switzerland
2005 - 2007	Postdoctoral Researcher and Teaching Assistant



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Univ. of Geneva, Switzerland

2002 2005 Teaching Assistant
Univ. of Montpellier, France

Research Interests

Quantitative topology in Riemannian and Finsler geometry, and more specifically systolic geometry and topology, and its links with contact geometry, symplectic geometry, convex geometry, dynamical systems, graph theory, geometry of numbers theory, lattices in Euclidean spaces, Teichmueller and moduli spaces.

Total number of publications :

17 scientific articles published in international mathematical journals with peer-reviewed

Five most relevant publications :

1- Isosystolic inequalities for optical hypersurfaces.

With Juan-Carlos Alvarez Paiva and Kroum Tzanev.

Advances in Mathematics (Impact Factor: 1.405)

Vol. 301 (2016), 934-972.

Cited 4 times.

2- Contact geometry and isosystolic inequalities.

With Juan-Carlos Alvarez Paiva.

Geometric And Functional Analysis (Impact Factor : 1.644)

Vol. 24 (2014), No 2, 648-669.

Cited 6 times.

3- Short loop decompositions of surfaces and the geometry of Jacobians.

With Hugo Parlier and Stéphane Sabourau.

Geometric And Functional Analysis (Impact Factor : 1.574)

Vol. 22 (2012), No 1 , 37-73.

Cited 10 times.

4- Diastolic and isoperimetric inequalities on surfaces.

With Stéphane Sabourau.

Annales Scientifiques de l'École Normale Supérieure (Impact Factor : 1.226)

Vol. 43 (2010), No 4, 579-605.

Cited 14 times.

5- A Zoll counterexample to a geodesic length conjecture.

With Christopher Croke and Mikhail G. Katz.

Geometric And Functional Analysis (Impact Factor: 1.313)

Vol. 19 (2009), No 1 , 1-10.

Cited 10 times.

H-index :

6 (cited 106 times by 68 authors)

Award for Scientific Excellence :

Allowance awarded two times (2009 and 2013) by the french government for a period of four years, based on a national competitive call and awarded to the best 25% researchers in pure mathematics

Invitations to give a talk :

25 invitations since 2012, among which 11 international ones (CMS winter conference in Montréal, Imperial College London, ICMAT in Madrid, Frankfurt University, BIRS in Canada,...)



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Organization of international conferences :

2016-2014-2012-2011-2008

Postdoctoral supervision :

2014-2016 : Supervision of Steve Karam, postdoctoral fellow of the grant Labex CEMPI (Lille, France)

Scientific Projects

2012 - 2017 Member of the grant ANR Geometry of Finsler and applications

2010 - 2012 Coordinator of the grant BQR Geodesic flows and their quantification

Journal referee for the following Journals :

Algebraic and Geometric Topology, Canadian Mathematical Bulletin, Duke Mathematical Journal (IF: 2.350), Differential Geometry and its Applications, l'Enseignement Mathématique, Geometric and Functional Analysis (IF: 1.476), Geometry and Topology (IF: 1.294), Journal of the AMS (IF: 2.836), Journal and P