Nice geometric analysis meeting
June 2-4 2014

Abstracts booklet

Pierre Bayard
Universidad Michoacana de San Nicolas de Hidalgo (Mexique)

On the spinor representation of space-like surfaces in 4-dimensional Minkowski space

Abstract

We will first talk about the following result : a space-like immersion of a surface in 4-dimensional Minkowski space may be represented by a spinor field solution of a Dirac equation on the surface. We will then apply this representation formula to the description of the flat surfaces with flat normal bundle and regular Gauss map in $\mathbb{R}^{3,1}$.

Alice Chang
Princeton University (Usa)

On positivity of a class of conformal covariant operators

Abstract

I will report on a recent joint work with Jeffrey Case in which we study the positivity of a class of non-local conformal covariant operators which are fractional GJMS operators defined via scattering theory on asymptotic hyperbolic manifolds, which includes the Dirichlet-Neumann operator as a special case. When the order of the operator is higher than 2, we will explore the positivity property of this class of operators via Sobolev trace extension formulas in the setting of metric spaces with measures.

Bruno Colbois
Université de Neuchâtel (Suisse)

Upper bounds for spectrum of the Laplacian on weighted manifolds

Abstract

I will discuss the existence of upper bounds for the spectrum of the Laplacian on a compact weighted manifold and how sharp they are. I will give an application to the spectrum of a Laplace type operator on a Riemannian vector bundle. Most of the talk is a joint work with A. El Soufi and A. Savo.

Yuxin Ge
UPEC (France)

Alexandrov-Fenchel type inequalities in the hyperbolic space

Abstract

In this talk, we describe the various Alexandrov-Fenchel inequalities and weighted Alexandrov-Fenchel inequalities in the hyperbolic space. As an application, we obtain an optimal Penrose type inequality for the new Gauss-Bonnet-Chern mass for a class of asymptotically hyperbolic manifolds. This talk is based on the joint works with Guofang Wang and Jie Wu.

Romain Gicquaud
Université de Tours (France)

On the constraint equations in general relativity

Abstract

The initial data for the Cauchy problem in general relativity are the metric g induced on the Cauchy surface and its second fundamental form K in the space-time solving the Einstein equations. It follows from the Einstein equations that g and K have to satisfy the so-called constraint equations. Solving the constraint equations then appears as an important problem in general relativity. Until recently, the known methods only allowed to construct solutions with constant or almost constant mean curvature $g^{ij}K_{ij}$. In this talk I will review recent breakthroughs in the construction of far from constant mean curvature solutions to the Einstein constraint equations.

Colin Guillarmou
CNRS et ENS (France)

Spectrum of geodesic flow on hyperbolic manifold

Abstract

We describe the Ruelle spectrum for the geodesic flow on compact hyperbolic manifolds. This is joint work with Dyatlov and Faure.

Emmanuel Humbert
LMPT, Université de Tours (France)

Some recent results on positive mass theorem

Abstract

I will present some recent results obtained with Andreas Hermann concerning positive mass theorem. In particular, we reduced the problem to showing that the positive mass theorem holds on any fixed non spin simply connected manifold.

Frank Pacard
Ecole Polytechnique (Paris)

Solutions without any symmetry for some nonlinear problems in the plane

Abstract

I will present a construction of entire solutions which are defined in the plane and have finite energy, for some nonlinear problems arising from physics. In particular, this yields the existence of solutions which have no symmetry. The construction is inspired from the construction of compact constant mean curvature surfaces in Euclidean 3-space by N. Kapouleas.

Tristan Rivière
ETHZ (Suisse)

Some results on the calculus of variations of Riemann surfaces

Abstract

We shall present various aspects of the minimization of functionals for immersion of surfaces under constrained conformal class. We will focus in particular on the variations of the Willmore and the area functional in the class of weak conformal immersions of given Riemann surfaces

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Frédéric Robert
Université de Lorraine (France)

On the Hardy-Schrodinger operator with a singularity on the boundary

Abstract

We consider borderline elliptic partial differential equations involving the Hardy-Schrodinger $L_\gamma := -\Delta - \gamma\frac{1}{|x|^2}$ operator on a domain $\Omega \subset \mathbf{R}^n$, when the singularity zero is on the boundary of the domain. This operator arises naturally when dealing with the Caffarelli-Kohn-Nirenberg inequalities and their associated Euler-Lagrange equations.

Now, it is well known that the operator L_γ is non-negative when 0 is in the interior of a domain as long as $\gamma \leq \frac{(n-2)^2}{4}$. The situation is much more interesting when $0 \in \partial\Omega$. For one, the operator is then non-negative for all $\gamma \leq \frac{n^2}{4}$. The problem of whether the Dirichlet boundary problem

$$-\Delta u - \frac{\gamma}{|x|^2}u = \frac{u^{2^*(s)-1}}{|x|^s} \text{ on } \Omega \tag{1}$$

has positive solutions is closely related to whether the best constants in the Caffarelli-Kohn-Nirenberg inequalities are attained. Here $2^*(s) = \frac{2(n-s)}{n-2}$ and $s \in [0,2)$. Brezis-Nirenberg type methods were used by C.S. Lin et al. to show that this is indeed the case when $\gamma < \frac{(n-2)^2}{4}$ under the condition that the mean curvature of the domain at 0 is negative. Their results extend previous work by Ghoussoub-Robert who dealt with the case $\gamma = 0$.

The case when $\frac{(n-2)^2}{4} \leq \gamma < \frac{n^2}{4}$ turned out to be much more delicate. A detailed analysis of the linear Hardy-Schrodinger operator L_γ performed recently by Ghoussoub-Robert surprisingly show that $\gamma = \frac{n^2-1}{4}$ is another critical threshold for the operator. While the C. S. Lin et al. results extend to the situation where $\gamma < \frac{n^2-1}{4}$, the interval $\gamma \in [\frac{n^2-1}{4}, \frac{n^2}{4})$ requires the introduction of a notion of "mass" in the spirit of Shoen-Yau for the Hardy-Schrodinger operator. The existence of solutions then depend on the sign of such a mass.

Pieralberto Sicbaldi
Aix-Marseille Université (France)

Constant mean curvature surfaces and overdetermined elliptic problems

Abstract

In this talk I will discuss the deep relation between overdetermined elliptic problems and constant mean curvature surfaces, and how the theory of minimal and constant mean curvature surfaces can be used in order to deal with the construction of new solutions of overdetermined elliptic problems or their classification.

Peter Topping
Warwick (England)

Teichmueller harmonic map flow into negatively curved targets

Abstract

The Teichmueller harmonic map flow is a way of finding minimal surfaces by performing a gradient flow for the harmonic map energy that is different from the harmonic map flow. I will describe what the flow is, sketch the basic theory, and then go on to describe some recent regularity theory. Joint work with Melanie Rupflin.

Marc Troyanov
EPFL-Lausanne (Suisse)

Recent Results in L_{qp}-Cohomology

Abstract

I will recall the basic definition of (reduced and non reduced) L_{qp}-Cohomology of a non compact Riemannian manifold, and survey relation with other notions of geometric analysis such the L_p-Hodge theorem, quasi-conformal structures or the topology at infinity. I will also present several notions of L_{qp}-Cohomology on metric measure spaces and discuss conditions for invariance under quasi-isometry.

Schedule

	Monday, June 2	Tuesday, June 3	Wednesday, June 4
10h30-11h00	*Welcome of participants*	*Welcome Coffee*	*Welcome Coffee*
11h00-11h45	Robert	Pacard	Colbois
11h50-12h35	Guillarmou	Topping	Troyanov
13h00-14h00	*Lunch break*	*Lunch break*	*Conference meal*
14h30-15h15	Chang	Sicbaldi	*End of the Conference*
15h20-16h05	Ge	Humbert	
16h05-16h30	*Coffee break*	*Coffee break*	
16h30-17h15	Gicquaud	Rivière	
17h20-18h05	Bayard		

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