Talks

Maximum Principles for Minimal Submanifolds in Riemannian Products

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Abstract. The aim of this paper is to elucidate some relations between the generalized Omori-Yau maximum principle and the maximum principle at infinity. In order to apply both principles to minimal submanifolds we use geometric barriers defined as k-mean convex hypersurfaces. As one of the main applications, inspired by a previous work by L. Alías, G. P. Bessa and M. Dajczer [1], we prove, under mild geometric assumptions, that a minimal submanifold properly immersed in a Riemannian product is at a positive distance from a k-mean convex hypersurface. This result follows from an extension of the barrier principle by L. Jorge and F. Tomi [4] in terms of a maximum principle at infinity. The existence of such barriers has as an analitycal counterpart the existence of subharmonic functions on minimal submanifolds. This extends to the case of Riemannian products some well-known results by U. Dierkes [2] and U. Dierkes and D. Schwab [3]. We also obtain several nonexistence and enclosure theorems for submanifolds with bounded mean curvature as well as to submanifolds evolving under the mean curvature flow in Riemannian products. This is a joint work with Jorge Herbert soares de Lira, Universidade Federal do Ceará.

References

[1] L. J. Alías, G. P. Bessa, M. Dajczer, *The mean curvature of cylindrically bounded submanifolds.* Math. Ann. **345** (2009), 367–376.

[2] U. Dierkes, *Maximum principles and nonexistence results for minimal submanifolds.* Manuscripta Math. **69** (1990), 203–218.

[3] U. Dierkes, D. Schwab, *Maximum principles for submanifolds of arbitrary codimension and bounded mean curvature.* Calc. Var. Partial Differential Equations **22** 2 (2005), 173-184.

[4] L. P. Jorge, F. Tomi, *The barrier principle for minimal submanifolds of arbitrary codimension.* Ann. Global Anal. Geom. **24** 3 (2003), 261-267.

Minimal Graphs in Heisenberg Space

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Abstract. I will explain some recent results about existence and non existence of minimal graphs in Heisenberg space. Moreover I will study the asymptotic behavior of minimal graphs on non compact domains.

The results are in collaboration with R. Sa Earp (PUC-Rio), E. Toubiana (Paris 7) and J. M. Manzano (Roma 3).

Fourth order evolution equations which describe pseudospherical surfaces

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Abstract. Differential equations that describe pseudospherical surfaces are equivalent to the structure equations of a metric with Gaussian curvature $K = -1$. These equations can also be described as the compatibility condition of an associated linear problem also referred to as a zero curvature representation. We will present the explicit classification of a class of fourth order evolution equations which describe pseudospherical surfaces, given in the paper [1]. The classification provides four huge classes (referred to as Types I-IV) of fourth order evolution equations that describe pseudospherical surfaces, together with the associated one (or more) parameter linear problems. The differential equations of each type are determined by choosing certain arbitrary differentiable functions. Fourth-order member of the Burgers hierarchy and a modified Kuramoto-Sivashinsky equation are examples of equations described by Types I and IV, respectively. Other explicit examples will be presented. This is a joint work with Keti Tenenblat, Universidade de Brasília.

References

[1] D. Catalano Ferraioli, K. Tenenblat, *Fourth order evolution equations which describe pseudospherical surfaces,* J. Differential Equations (2014), http://dx.doi.org/10.1016/j.jde.2014.06.010

On a new class of holonomy groups in pseudo-Riemannian geometry

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Abstract. The purpose of this talk is to attempt a brief overview of a joint paper with Alexey Bolsinov [1]. The notion of a Manakov operator is an important concept in the theory of integrable systems on semisimple Lie algebras. Incredibly, this concept nicely relates to the notion of a formal curvature tensor. It is this observation which enables us to elaborate the following construction. Given a smooth connected manifold M we consider the $(1,1)$-tensor fields acting on its tangent spaces. We then prove the existence of a class of pseudo-Riemannian metrics g on M such that the $(1,1)$-tensor fields have the following two properties. They are g-self adjoint and their centralisers in the Lie algebra $so(g)$ are holonomy algebras for the Levi-Civita connection of g. It deserves to be noticed that our construction holds for any signature of the metric g.

References

[1] Bolsinov, A; Tsonev, D. *On a new class of holonomy groups in pseudo-Riemannian geometry,* to appear in *J. Differential Geom.*

G_2-instantons over twisted connected sums

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Abstract. I will describe a method to construct G_2–instantons over compact G_2–manifolds arising as the twisted connected sum of a matching pair of asymptotically cylindrical Calabi-Yau 'building blocks', proposed by Kovalev and Corti-Haskins-Nordström-Pacini. It consists on gluing G_2–instantons obtained from holomorphic bundles over the building blocks via the gradient flow method, under boundary conditions 'at infinity' given by a certain notion of 'asymptotic stability'. One requires natural compatibility and transversality conditions which can be interpreted in terms of certain Lagrangian subspaces of a moduli space of stable bundles on a $K3$ surface.

Motivated by this construction, I will present techniques to produce such asymptotically stable bundles over building blocks. The most important tool is a generalisation of Hoppe's stability criterion to bundles over smooth projective varieties X with $\mathrm{Pic(X)} \simeq \mathbb{Z}^{\ell}$, a result which may be of independent interest.

Time allowing, I will show how linear monads can be used to produce a prototypical model of the curvature blow-up phenomenon along a sequence of asymptotically stable bundles degenerating into a torsion-free sheaf. This effect has been studied in full generality by Uhlenbeck-Yau over 4–manifolds and by Tian over higher dimensional manifolds with special holonomy.

The talk includes material from joint works with Thomas Walpuski and Marcos Jardim and Daniela Prata.

References

[1] Henrique N. Sá Earp, G_2-*instantons over asymptotically cylindrical manifolds*, arXiv:1101.0880v2 [math.DG] (2011).

[2] Henrique N. Sá Earp & Thomas Walpuski, G_2-*instantons on twisted connected sums*, arXiv:1310.7933v1 [math.DG] (2013).

[3] Marcos B. Jardim, Daniela M. Prata & Henrique N. Sá Earp, *Holomorphic bundles for higher dimensional gauge theory*, arXiv:1109.2750v2 [math.AG] (2014)

The Gaussian curvature via the contact angle of immersed surfaces into the Euclidean three sphere

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Abstract. The aim of this lecture is to present a relation for the Gaussian curvature of an immersed surface M^2 of the Euclidean three sphere which involves the contact angle. This allows us to conclude that its Gaussian is flat provided its contact angle is constant. Moreover, we deduce that the Clifford tori are the unique surfaces with constant mean curvature having such propriety.

References

[1] Gomes, J. N. V. *The Gaussian curvature via the contact angle of immersed surfaces into the Euclidean three sphere.* Diff. Geom. Appl. 31 (2013) 691697.

Rigidity of area-minimizing free boundary surfaces

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Abstract. We consider area-minimizing free boundary compact surfaces in mean convex three-manifolds and prove a local rigidity result. More precisely, we prove that in a certain borderline case the ambient manifold splits as a Riemannian product near the surface, which must have constant curvatures. As an application, we establish some global rigidity results for area-minimizing disks properly embedded in a mean convex three-manifold.

Finite density and the spectrum of minimal submanifolds in $\mathbb{H}^n$

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Abstract. Let $\varphi : M^m \to \mathbb{H}^n$ be a properly immersed minimal submanifold of the hyperbolic space $\mathbb{H}^n$ (or, more generally, of a manifold N suitably close to $\mathbb{H}^n$). In this paper, we are interested in the relationship between the spectrum of M and the finiteness of its density at infinity, that is, the finiteness of the limit

$$\lim_{r\to+\infty} \frac{\mathrm{vol}(M \cap B_r^n)}{\mathrm{vol}(B_r^m)},$$

where B_r^n, B_r^m are geodesic balls of radius r in $\mathbb{H}^n$ and $\mathbb{H}^m$, respectively. In particular, we prove that if M has finite density, then the spectrum $\sigma(-\Delta)$ of its Laplace-Beltrami operator is the whole half-line $[(m-1)^2/4, +\infty)$. Notably, the criterion applies to all Anderson's solutions of Plateau's problem at infinity on $\mathbb{H}^n$. We also give a simple condition on the second fundamental form II that ensures M to have finite density, and which does not imply any decay of $|\mathrm{II}|$ to zero, not even in an integral sense. This is a joint work with J.F. Montenegro, B.P. Lima and F.B. Vieira.

The Analytic Torsion of the finite metric cone over a compact manifold

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Abstract. We give explicit formulas for the L^2 analytic torsion of the finite metric cone over an oriented compact connected Riemannian manifold and we will discuss the extension of the Cheeger-Müller theorem in this configuration. This is a joint work with Mauro Spreafico.

References

[1] L. Hartmann and M. Spreafico, *The analytic torsion of a cone over a sphere*, J. Math. Pure Ap. 93 (2010) 408-435.

[2] L. Hartmann and M. Spreafico, *The Analytic Torsion of the Cone over an Odd Dimensional Manifold*, J. Geom. Phys. 61 (2011) 624-657.

[3] L. Hartmann and M. Spreafico, *The Analytic Torsion of the finite metric cone over a compact manifold*, arXiv:1308.5455.

Isometry flows on orbit spaces and applications to the theory of foliations

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Abstract. In this talk, we discuss the following result: Given a proper isometric action $K \times M \to M$ on a complete Riemannian manifold M then each continuous isometric flow on the orbit space M/K is smooth, i.e., it is the projection of an K-equivariant smooth flow on the manifold M. The first application of our result concerns Molino's conjecture, which states that the partition of a Riemannian manifold into the closures of the leaves of a singular Riemannian foliation is still a singular Riemannian foliation. We prove Molino's conjecture for the main class of foliations considered in his book, namely orbit-like foliations. We also discuss smoothness of isometric actions on orbit spaces. This talk is based on a joint work with Dr. Marco Radeschi (WWU- Münster) [1] and is aimed at a broad audience of students, faculties and researchers in Geometry.

References

[1] Marcos M. Alexandrino, Marco Radeschi, *Smoothness of isometric flows on orbit spaces and applications to the theory of foliations*. Preprint (2014) arXiv:1301.2735 [math.DG]

The p-hyperbolicity of infinite volume ends, Submanifolds and Cheng's type inequalities

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Abstract. In this talk we present a characterization of p-hyperbolic ends on complete Riemannian manifolds which carries a Sobolev type inequality. Namely

Let E be an end of a complete Riemannian manifold. Assume that for some constants, $1 < p \leq q < \infty$ and $C > 0$, E satisfies a Sobolev-type inequality of the form

$$\left(\int_E |u|^q\right)^{\frac{p}{q}} \leq C \int_E |\nabla u|^p,$$

for all $u \in W_0^{1,p}(E)$. Then E must either have finite volume or be p-hyperbolic.

This result extends a well known result due to P. Li and J. Wang [3].

As a consequence and following the ideas of [2] we prove that

Let $x : M^m \to \bar{M}$, with $m \geq 3$, be an isometric immersion of a complete non-compact manifold M in a manifold $\bar{M}$ with nonpositive sectional radial curvature. Given, $1 < p < m$, let E be an end of M such that the mean curvature vector satisfies $\|H\|_{L^q(E)} < \infty$, for some $q \in [p, m]$. Then E must either have finite volume or be p-hyperbolic. In particular, if M is a minimal submanifold, then each end is p-hyperbolic for $p \in (1, m)$.

We also apply our result to prove Cheng's inequalities for the p-Laplacian on Kähler and quaternionic Kähler manifolds.

The results of this talk are part of the work [1] in collaboration with M. Batista (UFAL) and N. Santos (UFPI).

References

[1] Batista, M; Cavalcante, M. P.; Santos, N. *The p-Hyperbolicity of Infinite Volume Ends and Applications.* arXiv:1301.2821. To appear in Geometriae Dedicata

[2] Cavalcante, M. P.; Mirandola, H.; Vitorio, F. *The non-parabolicity of infinite volume ends.* arXiv:1201.6391. To appear in Proc. Amer. Math. Soc.

[3] Li, P; Wang, J. *Minimal hypersurfaces with finite index.* Math. Res. Lett. **9** (2002), no. 1, 95–103.

Interpolation of geometric structures on complex and symplectic manifolds

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Abstract. On a smooth manifold M, generalized complex (generalized paracomplex) structures provide a notion of interpolation between complex (paracomplex) and symplectic structures on M [2, 1, 3].

Given a complex manifold (M, j), we define six families of distinguished generalized complex or paracomplex structures on M. Each one of them interpolates between two geometric structures on M compatible with j, for instance, between totally real foliations and Kähler structures, or between hypercomplex and $\mathbb{C}$-symplectic structures.

These structures on M are sections of fiber bundles over M with typical fiber G/H for some Lie groups G and H. We determine G and H in each case.

We proceed similarly for symplectic manifolds. We define six families of generalized structures on (M, ω), each of them interpolating between two structures compatible with ω, for instance, between a $\mathbb{C}$-symplectic and a para-Kähler structure (aka bi-Lagrangian foliation).

References

[1] Gualtieri, M. *Generalized complex geometry* Ann. Math. (2) 174 (2011) 75–123.

[2] Hitchin, N. *Generalized Calabi-Yau manifolds* Q. J. Math. 54 (2003) 281–308.

[3] Wade, A. *Dirac structures and paracomplex manifolds* C. R., Math., Acad. Sci. Paris 338 (2004) 889–894.

H_r-hipersuperfícies em $\mathbb{H}^n \times \mathbb{R}$

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Abstract. Nesta palestra, trataremos de hipersuperfícies com curvatura r-média constante, H_r-hipersuperfícies, em $\mathbb{H}^n \times \mathbb{R}$. Serão apresentados exemplos de H_r-hipersuperfícies em $\mathbb{H}^n \times \mathbb{R}$ completas invariantes por grupos a um parâmetro de isometrias. Usando esses exemplos como barreiras, apresentaremos alguns resultados geométricos interessantes incluindo estimativas de altura e um Teorema tipo Alexandrov. A palestra se baseia em um trabalho feito em colaboração com R. Sa Earp.

Polar actions on complex hyperbolic spaces

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Abstract. A connected subgroup H of the isometry group of a Riemannian manifold M acts polarly on M if there exists a submanifold Σ of M that intersects all the orbits of the H-action and always perpendicularly.

Polar actions on Euclidean spaces and irreducible symmetric spaces of compact type have been extensively investigated. Indeed, nowadays we know the complete classification in these cases; see [2], [3], [4]. However, the problem in the noncompact setting is much more involved. Wu classified polar actions on real hyperbolic spaces [5], but no more explicit classifications were known until two years ago.

In joint work with J. Carlos Díaz-Ramos and Andreas Kollross, we obtained the first complete classification of polar actions on a whole family of noncompact symmetric spaces of nonconstant curvature, namely on complex hyperbolic spaces [1]. Several algebraic and geometric techniques have been used in this result, for example the Iwasawa decomposition associated with a noncompact symmetric space, or the study of the extrinsic geometry of the singular orbits. In this talk, I will explain the main ideas and examples arising in this classification.

References

[1] Díaz-Ramos, J. C.; Domínguez-Vázquez, M.; Kollross, A. *Polar actions on complex hyperbolic spaces.* arXiv:1208.2823v2 [math.DG].

[2] Kollross, A. *Polar actions on symmetric spaces.* J. Differential Geom. **77** (2007), 425–482.

[3] Kollross, A.; Lytchak, A. *Polar actions on symmetric spaces of higher rank.* Bull. Lond. Math. Soc. **45** (2013), no. 2, 341–350.

[4] Podestà, F.; Thorbergsson, G. *Polar actions on rank-one symmetric spaces.* J. Differential Geom. **53** (1999), no. 1, 131–175.

[5] Wu, B. *Isoparametric submanifolds of hyperbolic spaces.* Trans. Amer. Math. Soc. **331** (1992), no. 2, 609–626.

The Weyl Criterion for the Spectrum

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Abstract. In our work with Zhiqin Lu we prove a generalization of Weyl's criterion for the spectrum of a self-adjoint and nonnegative operator on a Hilbert space [1]. We then apply this generalized criterion to study the L^2 spectrum of the Laplacian on k-forms over an open manifold. Using our new criterion we first expand the set of manifolds over which the essential spectrum of the Laplacian on functions is the nonnegative real line [1]. Then we show that the spectrum of the Laplacian on 1-forms always contains the spectrum of the Laplacian on functions. We also compute the essential spectrum of complete shrinking Ricci solitons and weighted manifolds in more general cases [2]. Finally, we apply our criterion to study the spectrum of the Laplacian on k-forms under a continuous deformation of the metric.

References

[1] Charalambous, N.; Lu, Z. *On the spectrum of the Laplacian.* Math. Ann. 59: 211–238, 2014.

[2] Charalambous, N.; Lu, Z. *Heat kernel estimates and the essential spectrum on weighted manifolds.* To appear in J. Geom. Anal..

On spherically symmetric Finsler metrics with vanishing Douglas curvature

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Abstract. We obtain the differential equation that characterizes the spherically symmetric Finsler metrics with vanishing Douglas curvature. By solving this equation, we obtain all the spherically symmetric Douglas metrics. Many explicit examples are included. This is a joint work with X. Mo and K. Tenenblat.

Min-max minimal hypersurfaces in non-compact manifolds

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Abstract. In this talk I will discuss about the existence of embedded closed minimal hypersurfaces in complete non-compact manifolds containing a bounded open subset with smooth and strictly mean-concave boundary and a natural behavior on the geometry at infinity. For doing this, we develop a modified min-max theory for the area functional following Almgren and Pitts' setting, to produce minimal surfaces with intersecting properties.

Helicoidal minimal surfaces in a Finsler space of Randers type

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Abstract. We consider the Finsler space $(\bar{M}^3, \bar{F})$ obtained by perturbing the Euclidean metric of $\mathbb{R}^3$ by a rotation. It is the open region of $\mathbb{R}^3$ bounded by a cylinder with a Randers metric. Using the Busemann-Hausdorff volume form, we obtain the differential equation that characterizes the helicoidal minimal surfaces in $\bar{M}^3$. We prove that the helicoid is a minimal surface in $\bar{M}^3$, only if the axis of the helicoid is the axis of the cylinder. Moreover, we prove that, in the Randers space $(\bar{M}^3, \bar{F})$, the only minimal surfaces in the one-parameter family of surfaces of Bonnet transformation with fixed axis $O\bar{x}^3$, are the catenoids and the helicoids. This is a joint work with Keti Tenenblat, Universidade de Brasília.

References

[1] Silva, R. M. da; Tenenblat, K. *Minimal Surfaces in a Cylindrical Region of* $\mathbb{R}^3$ *with a Randers Metric*, Houston Journal of Mathematics, 37, (2011), 745-771.

Sharp height estimates for spacelike hypersurfaces in GRW spacetimes

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Abstract. Recently the study of estimates for the height of constant mean curvature (CMC) compact spacelike graphs or, more generally, compact spacelike hypersurfaces with boundary, has become the subject of a rapidly increasing research. This is motivated by the fact that these estimates turn out to be a very useful tool in order to get existence and uniqueness results for CMC complete spacelike hypersurfaces, as well as to obtain information on the topology at infinity of such hypersurfaces.

A priori estimates for the height of CMC compact spacelike hypersurfaces in the Lorentz-Minkowski space and with boundary on a spacelike hyperplane, were first obtained by López [4] in case $n = 2$. Later on, in [5], Montiel obtained height estimates for compact spacelike graphs in the steady state spacetime, and he applied them to prove some existence and uniqueness theorems for CMC complete spacelike hypersurfaces in the de Sitter spacetime and prescribed asymptotic future boundary. In [3], Lima extended Lpez's result to any n and obtained sharp height estimates for compact spacelike hypersurfaces with some positive constant k-mean curvature ($1 \leq k \leq n$) in the Lorentz-Minkowski space and with boundary contained in a hyperplane. Later on, Colares and Lima, [1], were able to generalize this result to the case of Lorentzian product space $-\mathbb{R} \times \mathbb{P}^n$. These estimates depend on the k-mean curvature of the hypersurface and on a bound on the hyperbolic angle between the future-pointing unit normal vector field and the coordinate vector field induced by the universal time on $-\mathbb{R} \times \mathbb{P}^n$. Due to this feature, Colares and Lima applied them to the study of topological properties of positive CMC complete spacelike hypersurfaces.

In this talk we complete the picture described above by considering compact spacelike hypersurfaces with boundary immersed in a *generalized Robertson-Walker* (GRW) spacetime. As an application, we obtain some information on the topology at infinity of complete spacelike hypersurfaces of constant k-mean curvature properly immersed in a spatially closed GRW spacetime. Finally, using a version of the Omori-Yau maximum principle for the Laplacian and for more general elliptic trace-type differential operators, some non-existence results are also obtained. This is a joint work with Debora Impera, Universitá degli studi di Milano-Bicocca and the results contained in this talk can be found in the paper [2].

References

[1] Colares, A. G.; de Lima, H. F. *Space-like hypersurfaces with positive constant r-mean curvature in Lorentzian product spaces.* Gen. Relativ. Gravit. **40** (10) (2008), 2131–2147.

[2] Impera, D.; García-Martínez, S. C. *Height estimates and half-space theorems for spacelike hypersurfaces in generalized Robertson-Walker spacetimes.* Differential Geom. Appl. **32** (2014), 46–67.

[3] de Lima, H. F. *A sharp height estimate for compact spacelike hypersurfaces with constant r-mean curvature in the Lorentz-Minkowski space and application.* Differential Geom. Appl. **26** (4) (2008), 445–455.

[4] López, R. *Area monotonicity for spacelike surfaces with constant mean curvature.* J. Geom. Phys. **52** (3) (2004), 353–363.

[5] Montiel, S. *Complete non-compact spacelike hypersurfaces of constant mean curvature in de Sitter spaces.* J. Math. Soc. Jpn. **55** (4) (2003), 915–938.

A positive mass theorem for asymptotically flat manifolds with a non-compact boundary

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Abstract. I will discuss a positive mass theorem for non-compact manifolds with boundary, which have ends asymptotic to the Euclidean half-space. For spin manifolds or for dimensions up to 7, our result settles a conjecture posed in my recent paper [2] concerning the convergence of a Yamabe-type flow on manifolds with boundary. This is a joint work with Ezequiel Barbosa (UFMG) and Levi de Lima (UFC).

References

[1] Almaraz, S.; Barbosa, E.; de Lima, L.; *A positive mass theorem for asymptotically flat manifolds with a non-compact boundary.* arXiv:1407.0673.

[2] Almaraz, S.; *Convergence of scalar-flat metrics on manifolds with boundary under the Yamabe flow.* arXiv:1206.1184.

Linearization of symmetric 3-webs

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Abstract. We study non-flat planar 3-webs with infinitesimal symmetry. Using multi-dimensional Schwarzian derivative we prove that such a web can have at most 5 linearizations and give a criterion for linearization of such webs. A classification of linear non-flat 3-webs is also provided.

Different aspects of isoperimetry in noncompact Riemannian manifold

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Abstract. In this talk we will present some new results about the isoperimetric problem in the context of complete noncompact Riemannian manifolds. The problems treated here are: existence of isoperimetric regions, continuity and differentiability of the isoperimetric profile function. These results are already appeared in the articles included in the following bibliography. [1], [2], [3], [4].

References

[1] Stefano Nardulli. *The isoperimetric profile of a noncompact Riemannian manifold for small volumes.* Calc. Var. (2014) 49:173195.

[2] Stefano Nardulli. *Generalized existence of isoperimetric regions in non-compact Riemannian manifolds and applications to the isoperimetric profile.* The Asian Journal of Mathematics, Vol. 18, n. 1, 2014.

[3] Andrea Mondino; Stefano Nardulli. *Existence of isoperimetric regions in non-compact Riemannian manifolds under Ricci or scalar curvature conditions.* arXiv:1210.0567.(Submitted).

[4] Abraham Enrique Muñoz Flores; Stefano Nardulli. *Continuity and differentiability properties of the isoperimetric profile in complete noncompact Riemannian manifolds with bounded geometry.* arXiv:1404.3245.(Submitted).

Gap results for critical points of some geometrical variational problems

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Abstract. We consider critical points of the the global L^2-norm of the second fundamental form and of the mean curvature vector of isometric immersions of compact Riemannian manifolds into a fixed background Riemannian manifold, respectively, as functionals over the space of deformations of the immersion. We prove gap theorems for these functionals into hyperbolic manifolds, and show that the celebrated gap theorem for minimal immersions into the standard sphere can be cast as a theorem about their critical points of constant mean curvature function, and whose second fundamental form is suitably small in relation to it.

Inequalities for Eigenvalues of the Buckling Problem

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Abstract. Some inequalities for eigenvalues of the buckling problem will be introduced.

L^2 stability and rigidity of closed totally umbilical hypersurfaces in space forms

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Abstract. D. Perez proved an L^2 inequality for closed convex hypersurfaces in $\mathcal{R}^n$ and hence obtained the stability of closed totally umbilical hypersurfaces. The similar inequalities also hold in space forms. Recently, D. Zhou and I discussed the rigidity of closed totally umbilical hypersurfaces. Also, A. Juárez and I proved the optimality of constants in L^2 inequalities. Moreover, these inequalities can be generalized to hold for higher order mean curvatures.

Global smooth geodesic foliations of the hyperbolic space

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Abstract. We consider foliations of the whole three dimensional hyperbolic space $\mathbb{H}^3$ by oriented geodesics. Let $\mathcal{L}$ be the space of all the oriented geodesics of $\mathbb{H}^3$, which is a four dimensional manifold carrying two canonical pseudo-Riemannian metrics of signature $(2,2)$. We characterize, in terms of these geometries of $\mathcal{L}$, the subsets $\mathcal{M}$ in $\mathcal{L}$ that determine foliations of $\mathbb{H}^3$. We describe in a similar way some distinguished types of geodesic foliations of $\mathbb{H}^3$, regarding to which extent they are in some sense trivial in some directions: On the one hand, foliations whose leaves do not lie in a totally geodesic surface, not even at the infinitesimal level. On the other hand, those for which the forward and backward Gauss maps $\varphi^{\pm} : \mathcal{M} \to \mathbb{H}^3(\infty)$ are local diffeomorphisms. Besides, we prove that for this kind of foliations, $\varphi^{\pm}$ are global diffeomorphisms onto their images.

The subject of this talk is within the framework of foliations by congruent submanifolds, and follows the spirit of the paper by Gluck and Warner [1] where they understand the infinite dimensional manifold of all the great circle foliations of the three sphere. The Euclidean analogue was studied in [2].

Joint work with Marcos Salvai.

References

[1] Gluck, H; Warner, F. *Great circle fibrations of the three-sphere.* Duke Math. J. 50 (1983) 107–132.

[2] Salvai, M. *Global smooth fibrations of* $\mathbb{R}^3$ *by oriented lines.* Bull. London Math. Soc. 41 (2009) 155–163.