Workshop on Submanifold Theory and Geometric Analysis

UFSCar, São Carlos, Brazil, August 05 – 09, 2019

Monday- 9:30h - 10:20h -Auditório do DM

Carlos Olmos

(Córdoba - Argentina)

Homogeneous Riemannian manifolds with non-trivial nullity

Abstract. The main purpose of this lecture is to introduce to techniques in homogeneous geometry based in geometric constructions and Killing fields rather than the usual Lie algebra point of view. For this purpose we will speak about a classical problem in Riemannian geometry, which goes back to Chern-Kuiper, which is the study of the nullity distribution of the curvature tensor. For homogeneous Riemannian manifolds nothing was known about this problem, not even a non-trivial example. In a recent work with A.J. Di Scala and F. Vittone we developed a general theory for homogeneous spaces $M = G/H$ in relation with the nullity. We construct natural invariant (different and increasing) distributions associated with the nullity, that give a deep insight of such spaces. In particular, there must exist an order-two transvection, not in the nullity, with null Jacobi operator. This fact was very important for finding out the first homogeneous examples with non-trivial nullity, i.e. where the nullity distribution is not parallel. Moreover, there are irreducible examples of conullity $k = 3$, the smallest possible, in any dimension. We also proved that H is trivial and G is solvable if $k = 3$ (and it is an open problem whether G must be always solvable) The leaves of the nullity of M are closed (this involves a delicate argument). This implies that M is a Euclidean affine bundle over the quotient by the leaves of the nullity. Moreover, the perpendicular distribution of the nullity defines a metric connection on this bundle with transitive holonomy or, equivalently, a completely non-integrable distribution (this is not in general true for an arbitrary autoparallel and flat invariant distribution). There are some general obstruction for the existence of non-trivial nullity: e.g., if G is reductive (in particular, if M is compact), or if G is two-step nilpotent.

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Monday- 10:30h - 11:20h -Auditório do DM

Luis Florit

(IMPA - Brazil)

Extrinsic surgeries for positive scalar curvature

Abstract. In this joint work with B. Hanke we extend the Gromov-Lawson Theorem about surgeries for positive scalar curvature (PSC). We show that the space of compact Euclidean n-dimensional submanifolds with PSC is closed under surgeries of codimension $k \geq 3$, provided that the codimension is greater than $n - k + 1$. As an easy consequence we obtain a Whitney type theorem for PSC: Every compact non-spin n-dimensional Riemannian manifold admits an immersion with PSC in $\mathbb{R}^{2n+7}$.

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Monday- 11:30h - 12:00h -Auditório do DM

Felippe Guimarães

(IMPA - Brazil)

Complete submanifolds with relative nullity

Abstract. We use techniques based on the splitting tensor to explicitly integrate the Codazzi equation along the relative nullity distribution and express the second fundamental form in terms of the Jacobi tensor of the ambient space. This approach allows us to easily recover some important results in the literature on complete submanifolds with relative nullity, as well as derive new consequences in hyperbolic and Euclidean spaces.

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Monday- 14h - 14:50h -Auditório do DM

Oscar Palmas

(UNAM, Mexico)

Geometry of null hypersurfaces

Abstract. Null hypersurfaces in semi-Riemannian manifolds are those whose induced metric is degenerate. In this talk we will give an overview of their treatment and some recent results.

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Monday- 15h - 15:30h -Auditório do DM

Feliciano Vitório

(UFAL, Brazil)

Prescribing the curvature of Riemannian manifolds with boundary

Abstract. Let M be a compact connected surface with boundary. We prove that the signal condition given by the Gauss-Bonnet theorem is necessary and sufficient for a given smooth function f on ∂M (resp. on M) to be geodesic curvature of the boundary (resp. the Gauss curvature) of some flat metric on M (resp. metric on M with geodesic boundary). In order to provide analogous results for this problem with $n \geq 3$, we prove some topological restrictions which imply, among other things, that any function that is negative somewhere on ∂M (resp. on M) is a mean curvature of a scalar flat metric on M (resp. scalar curvature of a metric on M and minimal boundary with respect to this metric). As an application of our results, we obtain a classification theorem for manifolds with boundary. This is a joint work with Tiarlos Cruz (UFAL).

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Monday- 16h - 16:50h -Auditório do DM

Levi Lopes de Lima

(UFC - Brazil)

The positive mass theorem for asymptotically hyperbolic manifolds with noncompact inner boundary and applications

Abstract. We present a sharp positive mass inequality for the class of manifolds in the title in the spin setting, under suitable dominant energy conditions. We then discuss applications, including a rigidity result in the class of conformally compact Einstein metrics which extends to this context a celebrated result by Andersson-Dahl and makes contact with the so-called AdS/BCFT correspondence, a version of the classical AdS/CFT correspondence in which the conformal boundary itself carries a nonempty boundary. Joint work with S. Almaraz.

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UFSCar, São Carlos, Brazil, August 05 – 09, 2019

Monday- 17h - 17:50h -Auditório do DM

Marcus A. M. Marrocos

(UFABC - Brazil)

On the spectrum of warped products and g-manifolds

Abstract. In this conference we study the generic spectrum of warped products and G-manifolds (that contain principal bundles). We estabhish a kind of splinting eigenvalues theorem considering a family of differential operator on the base of a warped product. As a consequence, we prove a density theorem for a set of warping functions that makes the spectrum of the Laplacian a warped-simpled spectrum. This is then used to study the generic situation of the eigenvalues of the Laplacian on a class of compact G-manifolds. In particular, we give a partial answer to a question posed 1990 by Steven Zelditch about the generic situation of multiplicity of the eigenvalues of the Laplacian on principal bundles.

References:

[1] UHLENBECK K. - *Generic properties of eigenvalues*, Amer. J. Math. 98 (4) (1976) 1059-1078.

[2] Zelditch S. - *On the generic spectrum of a riemannian cover*, Ann Inst. Fourier (Grenoble) 40 (1990) 407-442.

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