

X Workshop on Differential Geometry

Hotel Ponta Verde, Maceió 10 - 14 March 2025

Titles and Abstracts

Monday, March 10

Greg Galloway

Existence of CMC Hypersurfaces in Cosmological Spacetimes

Abstract: Constant mean curvature (CMC) spacelike hypersurfaces have played an important role in mathematical relativity, in particular in the study of the Einstein equations, both in terms of solving the initial data constraints, and in evolving CMC initial data. In this talk we present some existence results for CMC spacelike hypersurfaces (both old and new), in the class of cosmological (spatially closed) spacetimes. These results were motivated, in large measure, by the Bartnik splitting conjecture, as well as more recent conjectures of Dilts and Holst. The Bartnik Splitting Conjecture, which we will discuss in some detail, is a concrete formulation of a problem posed by S.-T. Yau in the 1980's of establishing the 'rigidity' of the Hawking-Penrose singularity theorems. This talk is based on joint work with Eric Ling.

Almir Santos

Conformal Deformation with Prescribed Curvature on Surfaces with Boundary

Abstract: The classical problem of finding conformal metrics with prescribed Gaussian curvature on closed surfaces has been an active area of research since the seminal works of Berger and Kazdan-Warner in the 1970s. Recent research has increasingly focused on surfaces with boundary. This talk will address the problem of finding conformal metrics with prescribed Gaussian and geodesic curvatures on surfaces with negative Euler characteristics. We will place particular emphasis on multiple solutions and blow-up phenomena. This is joint work with R. Caju (Universidad de Chile) and T. Cruz (UFAL).

José Espinar

Overdetermined Elliptic Problems in S^2 and the Critical Catenoid Conjecture

Ana Menezes

Eigenvalue Problems and Free Boundary Minimal Surfaces in Spherical Caps

Abstract: In a joint work with Vanderson Lima (UFRGS, Brazil), we introduced a family of functionals on the space of Riemannian metrics of a compact surface with boundary, defined via eigenvalues of a Steklov-type problem. In this talk we will prove that each such functional is uniformly bounded from above, and we will characterize maximizing metrics as induced by free boundary minimal immersions in some geodesic ball of a round sphere. Also, we will prove rotational symmetry of free boundary minimal annuli in geodesic balls of round spheres which are immersed by first eigenfunctions.

Tuesday, March 11

Tristan Rivière

Canonical Families in Minmax Theory

Abstract: We will illustrate by examples the role of canonical families in solving minmax problems.

Ivaldo Nunes

Stability of Extremal Domains for the First Dirichlet Eigenvalue of the Laplacian Operator

Abstract: In this talk we discuss the concept of stable extremal domains for the first Dirichlet eigenvalue of the Laplacian operator. We classify stable extremal domains in the 2-sphere and higher-dimensional spheres when the boundary is minimal. Additionally, we establish topological bounds for stable domains in compact Riemannian surfaces, assuming either nonnegative total Gaussian curvature or small volume. This is joint work with Marcos P. Cavalcante (UFAL).

Shuli Chen

Positive scalar curvature metrics and aspherical summands

Abstract: A closed manifold is called aspherical if it has contractible universal cover. It has been conjectured since the 80s that all closed aspherical manifolds do not admit metrics with positive scalar curvature (PSC). In dimensions 3,4,5 this conjecture is solved by works of Schoen—Yau, Gromov—Lawson, Chodosh—Li, and Gromov. We prove for $n = 3,4,5$ that the connected sum of a closed aspherical n -manifold with an arbitrary non-compact manifold does not admit a complete metric with PSC. For $n = 3, 4$, we further look at the manifold $M \setminus S$ obtained from a closed aspherical n -manifold M by deleting a subset S consisting of disjoint incompressible embedded closed aspherical submanifolds (possibly with different dimensions), and show it does not admit a complete metric with PSC. This is joint work with Jianchun Chu and Jintian Zhu.

Isabel Fernández

Capillary surfaces in the ball

Wednesday, March 12

Laurent Hauswirth

From Architecture to Minimal Surfaces

Vanderson Lima

On the First Min-Max Width of Hyperbolic Surfaces

Abstract: In this talk I will describe my recent work concerning the first Min-Max width of closed Riemannian surfaces of negative curvature. The main result is a characterization for configurations of closed geodesics arising from Allen-Cahn solutions whose energy is bounded and the sum of Morse index and nullity is at most one, including the fact every geodesic occurs with multiplicity one. As an application I obtained a sharp lower bound for the first width of closed hyperbolic surfaces, which is only attained asymptotically.

Thursday, March 13

Magdalena Rodríguez

Ideal Boundary of Minimal and Constant Mean Curvature Surfaces in $\mathbb{H}^2 \times \mathbb{R}$

Maria Andrade

Rigidity results for Serrin's overdetermined problems in Riemannian manifolds

Abstract: In this talk, we will present some results about Serrin's overdetermined problems in Riemannian manifolds. Moreover, for manifolds endowed with a conformal vector field, we prove a Pohozaev-type identity to establish a Serrin-type rigidity result using the P-function approach introduced by Weinberger. This is part of a joint work with Allan Freitas (UFPB, Brazil) and Diego Marín (Universidad de Granada, Spain).

Eduardo Longa

Extremal Metrics for the Neumann Laplacian

Abstract: We show there are no extremal metrics for the eigenvalues of the Neumann Laplacian on any compact manifold. Nonetheless, we construct infinitely many examples of conformally extremal metrics for the eigenvalues of this operator in domains of an unduloid and characterise these special metrics in the general case of a compact manifold of dimension $n \geq 2$.

Henrique Sá Earp

Updates on Flows of Geometric Structures

Abstract: I will recall some results towards a general theory for flows of H-structures, obtained with Fadel, Loubeau and Moreno. Then I will present some recent results on SU(2)-flows on 4-manifolds, initiating a classification programme of 'parabolic' flows, based on a representation-theoretic method originally due to Bryant in the context of G2 geometry, obtained with Fowdar.

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Friday, March 14

Jorge Lira

TBA

Feliciano Vitório

Volume minimizing hypersurfaces in DEC Riemannian manifolds are rigid

Abstract: In this talk, we prove some rigidity results for volume-minimizing hypersurfaces in DEC Riemannian manifolds. This is joint work with D. Ribeiro (UFAL).

Sergio Almaraz

A priori estimates for conformal metrics with negative constant scalar curvature and positive constant boundary mean curvature

Abstract: I will discuss compactness results for the full set of solutions to the Yamabe problem on compact Riemannian manifolds with boundary, introduced by Escobar in the 1990's. I will present a result for three dimensional manifolds of positive Yamabe type in the case the scalar curvature is a negative constant and the boundary has constant mean curvature. This is joint work with Shaodong Wang (Nanjing University of Science and Technology)..