Book of Abstracts

Chiara Bernardini

Title: Serrin-type problems on ring-shaped domains: rigidity results

Abstract: We provide a characterization of rotationally symmetric solutions to the Serrin problem on ring-shaped domains in $\mathbb{R}^n$ ($n \geq 3$). Our approach is based on a comparison-geometry argument. By exploiting a suitable conformal reformulation of the problem, we obtain sharp gradient estimates, which play a central role in establishing our main rigidity theorem. The comparison method can be effectively extended to deal with quasilinear operators. This will be discussed in the second part of the talk, where we focus on the case of the p-Laplacian torsion problem. This talk is based on joint works with V. Agostiniani, S. Borghini, L. Mazzieri and A. Pinamonti.

Kahnrad Braxton

Title: Stability and Morse Index of a Self-Shrinking Möbius Band in Four Dimensions

Abstract: Self-shrinkers are special surfaces that model how shapes collapse under mean curvature flow, and their Morse index measures how many independent ways they can be perturbed to decrease the associated area-type functional. In this talk, I will discuss the stability and Morse index of a particular self-shrinking Möbius band sitting in four-dimensional Euclidean space. I will describe how passing to the orientable double cover of the Möbius band allows us to build a global orthonormal frame of normal directions and carry out explicit geometric computations, including the metric, the mean curvature vector, and the stability operator. A key feature of this example is that the mean curvature never vanishes, which simplifies the higher-codimension curvature terms that usually make the analysis much harder. Using the natural rotational symmetry of the surface and the structure of the double cover, I decompose normal variations into Fourier modes and reduce the stability problem to a family of one-dimensional ordinary differential equations with natural boundary conditions at infinity. I will explain this reduction, how it leads to a clean decoupling of the problem into separate modes, and what this reveals about the overall stability and Morse index of the self-shrinking Möbius band.

Lorenzo Carletti

Title: Higher order critical Sobolev inequalities on manifolds, optimal constants and dependence on the geometry

Abstract: We are interested in the optimal constant problem for the critical Sobolev embedding of the space $H^k(M)$ into $L^{2^\sharp}(M)$, where k is a positive integer, (M, g) is a closed Riemannian manifold of dimension $n > 2k$, and $2^\sharp = \frac{2n}{n-2k}$ is the critical Sobolev exponent. In this context, we investigate whether the first optimal constant is attained, with the same value as in the Euclidean setting. We show that the geometry of the manifold plays a crucial role in the validity of the optimal inequality, depending on the nature of the lower-order remainder term that is chosen. The proof strategy works independently of the order of the problem and relies on the study of the precise pointwise behavior of an asymptotically singular sequence of positive

solutions to a critical polyharmonic equation with diverging coefficients. This is joint work with Frédéric Robert (IECL Nancy).

Giacomo Cozzi

Title: Stability of the Ball in Isoperimetric Inequalities Between Two Fractional Perimeters

Abstract: We prove that the ball is a local minimizer of the scale invariant isoperimetric ratio between two fractional perimeters under C^1 small graph perturbations. To establish this, we show that the second variation of this functional is coercive with respect to a suitable Sobolev norm for functions defined over the unitary sphere in $\mathbb{R}^n$. This parallels the results known in the literature where one of the two fractional perimeters is replaced by the volume. This is a joint work with G. Alberti, J. Mirmina (Università di Pisa) and A. Massaccesi (Università degli Studi di Padova).

Joshua Daniels-Holgate

Title: Non-uniqueness in Mean Curvature Flow

Abstract: When mean curvature flow evolves non-uniquely, the flow is said to fatten. The work of Ilmanen shows that any weak MCF is supported inside the fattening, and work of Hershkovits–White identified canonical weak flows supported on the boundary of the fattening, known as the outermost flows. It is natural to ask, when the flow fattens, are there weak mean curvature flows supported strictly inside the fattening? Outside of some special cases (e.g. flow from cones), this question was entirely open. We show these interior flows exist, providing a general construction for non-outermost flows as limits of solutions to the parabolic ε-Allen—Cahn flow.

Antoine Detaille

Title: A surprising threshold for the method of singular projection **Abstract:** The method of singular projection, introduced by Hardt and Lin (1987) with roots in the work of Federer and Fleming (1960), is a very useful tool in geometric analysis, that essentially allows to apply linear techniques to some problems to which they would normally not because of a nonlinear constraint. Its range of applications comprises the approximation problem of mappings into manifolds to the study of minimizing harmonic maps. In this talk, I will introduce and explain this method, illustrate its importance by reviewing some of its applications, and conclude with a recent result featuring a surprising threshold in the values of the parameters for which this method applies in the context of fractional Sobolev spaces with less than one derivative, answering a folklore question raised notably by the harmonic maps community.

Natasha Diederan

Title: Increase in topological complexity along the mean curvature flow

Abstract: A hypersurface evolves by mean curvature flow if it moves with velocity equal to its mean curvature vector at each point. The process is described by a non-linear parabolic PDE,

and solutions form singularities in finite time. A central question in the is the classification of these singularities, and the behaviour of the flow as it moves through them. For surfaces in three-dimensional space, the picture is well understood: all singularities are modelled by self-shrinkers of multiplicity one and the genus is non-increasing with time. However, in higher dimensions, the topology can become more complex after the first singular time. In this talk we present an explicit example of such behaviour.

Natasha Diederan

Maria Fernanda Espinal Florez

Title: On the existence and classification of k-Yamabe gradient solitons

Abstract: The k-Yamabe flow is a fully nonlinear extension of the Yamabe flow that appears naturally in problems related to topological classification in higher dimensions. In this talk we describe the construction, classification and asymptotic behavior of radially symmetric gradient k-Yamabe solitons that are locally conformally flat ([ES25]), these are special solutions to the flow that play a central role in the theory. Our study extends results by Daskalopoulos and Šešum in ([DS13]) in the case $n > 2k$. This is joint work with Mariel Sàez.

References:

DS13 P. Daskalopoulos, N. Sesum *The classification of locally conformally flat Yamabe solitons*, Adv. Math. 240 (2013), 346–369.

ES25 M. F. Espinal, M. Sáez, *On the existence and classification of k-Yamabe gradient solitons*, J. Geom. Anal. 35 (2025).

Marcus Flook

Title: Mean curvature flow analogues in Cauchy-Riemann (CR) Geometry

Abstract: In this talk, I will introduce and motivate domains of holomorphy and Cauchy-Riemann (CR) geometry by considering real hypersurfaces embedded in complex Euclidean space. I will introduce flows of CR hypersurfaces that are analogous to the mean curvature flow and discuss joint research with Ben Andrews on new flows which preserve key components of the CR structure. This talk will be accessible to those with a background in Riemannian geometry.

Mattia Freguglia

Title: Yamabe metrics on conical manifolds I: existence results via local geometry

Abstract: We consider the Yamabe equation on conical manifolds with Ricci-flat tangent cones. In contrast to the case of smooth closed manifolds, solutions may fail to exist in the singular setting. However, in dimension $n \geq 4$, and under a generic condition on the metric near the conical points, we show the existence of a minimizing solution. Based on a joint work with Andrea Malchiodi (SNS).

Francesco Malizia

Title: Yamabe metrics on conical manifolds II: existence results via min–max methods

Abstract: While the Yamabe problem is completely solved on smooth closed manifolds, its extension to singular spaces presents significant new challenges. In particular, minimizers of the Yamabe functional may fail to exist. In this talk, we prove the existence of Yamabe metrics on four-manifolds with finitely many conical points with $Z/2Z$-group, using for the first time a min–max scheme in the singular setting. In our proof, we exploit recent positive mass theorems in the conical setting and study how the mass of the conformal blow-up diverges as the blow-up point approaches the singular set. This is based on joint work with Mattia Freguglia (Bocconi) and Andrea Malchiodi (SNS).

Dorian Martino

Title: Weak immersions with a second fundamental form in a critical Sobolev space

Abstract: Generalized Willmore energies have been studied in the past decade due to their relationship with renormalized volume of minimal submanifolds and their applications in AdS/CFT correspondence. In this talk, I will present an analytical framework developed in collaboration with Tristan Rivière in order to study variational problems for such Lagrangians.

Ivan Miranda de Almeida

Title: On the stability of CMC hypersurfaces

Abstract: A weakly stable immersed CMC hypersurface minimizes area up to second order among variations that preserve the enclosed volume. We present results on the classification of complete examples in six-dimensional space forms.

Isaac Newell

Title: Cartan's and Gauss' equations and rigidity theorems for isometric embeddings in low Sobolev regularity

Abstract: Let $\{\eta^i\}_{i=1}^2$ be an orthonormal coframe on a subdomain U of a smooth surface (Σ, g). When η^i is smooth, there is a unique connection 1-form ω satisfying Cartan's structural equations $d\eta^1 = \eta^2 \wedge \omega$ and $d\eta^2 = -d\eta^1 \wedge \omega$, and moreover the second structural equation $d\omega = K_g dvol_g$ holds. We show that these equations remain valid in the sense of distributions when the frame has only $C^0 \cap H^{1/2}$ regularity. From this, analogous results for the Gauss equation $\det D^2 = K_g(1+|Df|^2)^2$ for the graphical representation of an isometric embeddings $u\colon \Sigma \to \mathbb{R}^3$ can be deduced. The later equation remains true if $u \in C^1 \cap W^{1+\frac{2}{3},3}$ or $BV^2 \cap c^{1,\frac{1}{2}}$ with the distributional Hessian $\operatorname{Det} D^2 f$ replacing $\det D^2 f$. As an application, we prove regularity and convexity results in the case of positive Gaussian curvature, extending earlier work by Conti–De Lellis–Székelyhidi (Abel Symposium, 2010), Giron (DPhil thesis, 2021) and Pakzad (J. Funct. Anal., 2024). This is joint work with Luc Nguyen.

Andrew Roberts

Title: A conservation law for ε-harmonic maps

Abstract: In order to account for the problems in regularity theory and existence in harmonic map theory various approximations to Dirichlet energy have been devised. One of these is the ε-energy introduced by Lamm which I will discuss a conservation law for. This is joint work with Carolin Bayer (ETH Zurich).

Sebastian Woodward

Title: Quantitative stability estimates near infinitely concentrated minimisers

Abstract: I will discuss joint work with Professor Melanie Rupflin, which establishes quantitative stability estimates for degree one maps of the Dirichlet Energy from either the torus or hyperbolic surfaces into the sphere. While the classical question of quantitative stability fails due to the non-existence of degree one minimisers from the given surface, the existence of a singular minimiser consisting of a "bubble" and "base map" can be shown. In this work, we establish a quantitative stability estimate for this set of singular minimisers through a carefully constructed combined gradient flow that evolves both domain and map.