

Talks in the ESDG

First week

Monday 24

Speaker: Gabriella Tarantello (University of Rome Tor Vergara)

Title: On CMC-immersions of surfaces into Hyperbolic 3-manifolds.

Abstract: I shall discuss the moduli space of Constant Mean Curvature (CMC) c -immersions of a closed surface S (orientable and of genus at least 2) into hyperbolic 3-manifolds. Interestingly when $|c| < 1$, such space admits a nice parametrization described by elements of the tangent bundle of the Teichmueller space of S . Indeed, for any such element we shall see how to determine uniquely the pullback metric and the second fundamental form of the immersion by solving the “constrained” Gauss-Codazzi equations. This is attained by showing that the associated action functional (known as the “Donaldson-functional” in Gonsalves-Uhlenbeck (2007)) admits a global minimum as its unique critical point.

In addition I shall discuss the asymptotic behavior of those minimizers as $|c|$ approaches 1 and see when it is possible to obtain “convergence” to a (CMC) 1-immersion. Note that (CMC) 1-immersions into the hyperbolic space are particularly relevant in hyperbolic geometry in view of their analogies with minimal immersions into the Euclidean space.

For example, we show that for genus 2, it is possible to catch at the limit a “regular” CMC 1-immersion into an hyperbolic 3-manifold, except in very rare situations which relate to the image, under the Kodaira map, of the six Weierstrass points of S . Finally, I shall discuss further progress for higher genus obtained in collaboration with S. Trapani.

Speaker: M. Traizet (University of Tours)

Title: Loop group methods for the non-abelian Hodge correspondence on a 4-punctured sphere.

Abstract: The non-abelian Hodge correspondence is a real analytic map between the moduli space of Higgs bundles and the De Rham moduli space of flat connections on a compact Riemann surface, mediated by harmonic maps from that Riemann surface to hyperbolic space.

We use loop-group methods to construct (equivariant) harmonic maps from a 4-punctured sphere to hyperbolic space \mathbb{H}^3 . This is quite similar to the construction of Lawson minimal surfaces in the sphere \mathbb{S}^3 using loop-group methods.

Our construction allows us to compute quite explicitly the non-abelian Hodge correspondence in the case of a 4-punctured sphere with small parabolic weights. In particular we are able to identify the natural hyper-Kähler metric on the moduli space.

Joint work with L. Heller and S. Heller.

Tuesday 25

Speaker: Claude LeBrun (Stony Brook University)

Title: Einstein Metrics, 4-Manifolds, and Gravitational Instantons

Abstract: A Riemannian metric is said to be **Einstein** if it has constant Ricci curvature. Certain peculiar features of 4-dimensional geometry make dimension four into a “Goldilocks zone” for Einstein metrics, with just the right amount of local flexibility managing to coexist with strong global rigidity results. This talk will first describe some aspects of the interplay between Einstein metrics and smooth topology on compact symplectic 4-manifolds without boundary. We will see how ideas from Kähler and conformal geometry allow us to construct Einstein metrics on many such manifolds, while a complimentary tool-box shows that these existence results are optimal in certain specific contexts. The talk will then conclude with a brief discussion of analogous results concerning complete Ricci-flat 4-manifolds.

Speaker: Ana Menezes (Princeton University)

Title: TBA

Abstract:

Wednesday 26

Speaker: Andrea Seppi (Université Grenoble Alpes)

Title: Uniqueness and non-uniqueness for the Asymptotic Plateau Problem in hyperbolic three-space.

Abstract: The Asymptotic Plateau Problem in the hyperbolic space is the problem of existence of minimal surfaces with a prescribed Jordan curve as a boundary “at infinity”. Since the work of Anderson in the 1980s, it is known to have a solution, which is however in general not unique. In this talk, I will give an overview of the subject, present examples of “pathological” non-uniqueness, and describe some criteria for uniqueness.

Thursday 27

Speaker: Felix Schulze (Warwick University)

Title: TBA

Abstract:

Speaker: Theodora Bourni (University of Tennessee)

Title: Constructing solution to curve shortening and related flows.

Abstract: We will discuss the construction of certain interesting solutions to curve shortening and related flows. Some of these lead to classification results for ancient solutions.

Friday 28

Speaker: Theodoros Vlachos (University of Ioannina)

Title: TBA

Abstract:

Speaker: Laurent Mazet (University of Tours)

Title: A rigidity result for free boundary minimal disks.

Abstract: Thanks to the work of J. Jost, any convex Riemannian 3-ball contains either a minimal sphere or a free boundary minimal disk. If the Ricci curvature is non negative and the principal curvatures of the boundary are non less than 1, we will explain that it is then possible to control the perimeter of the free boundary minimal disk by 2π . Moreover the perimeter is equal to 2π if and only if the 3-ball is the Euclidean ball of radius 1. This is a joint work with Abraao Mendes.

Speaker: Roman Petrides (Université Paris Diderot)

Title: TBA

Abstract:

Second week

Monday 1

Speaker: Antonio Ros (University of Granada)

Title: TBA

Abstract:

Speaker: Alexander Bobenko (Institut für Mathematik, TU Berlin)

Title: TBA

Abstract:

Tuesday 2

Speaker: Tristan Rivière (ETH)

Title: TBA

Abstract:

Speaker: Lucas Ambrozio (IMPA, Brazil)

Title: Generalizations of Zoll surfaces in minimal submanifold theory

Abstract: A Zoll surface is a Riemannian surface homeomorphic to a sphere whose non-trivial geodesics are all closed and have the same length. As surprising as it may seem, there are Zoll surfaces that are not the Euclidean sphere. And while these surfaces have been known for more than a hundred years, their full classification remains elusive.

However, Zoll surfaces are not only interesting geometric objects in themselves. We will discuss two variational problems where Zoll surfaces appear to be central objects to be understood. This will motivate the introduction of generalised notions of Zoll surfaces in the context of minimal submanifold theory, where similar variational problems are meaningful and have only recently started to be investigated. Finally, we will discuss the recent progress done towards the development of a general theory of higher dimensional Zoll-like objects.

Wednesday 3

Speaker: Paul Laurain (Université Paris Cité)

Title: Morse Index stability for Yang-Mills fields.

Abstract: After introducing the Yang-Mills setting, I will review some classical works about Yang-Mills in critical dimension (dimension 4) such as Uhlenbeck's gauge extraction and quantization of the energy. Finally, I will show how, with M. Gaurit, we have proved the upper and lower semi-continuity for the index of sequences of Yang-Mills fields.

Thursday 4

Speaker: Nicolaos Kapouleas (Brown University)

Title: Recent results on minimal (hyper)surface doublings and desingularizations

Abstract: As an introduction I will recall earlier results on gluing constructions of minimal surfaces by PDE methods. I will concentrate then on recent results (in collaboration with Jiahua Zou) and ongoing work.

Speaker: David Wiygul (Università degli studi di Trento)

Title: TBA

Abstract:

Friday 5

Speaker: Giada Franz (MIT)

Title: Construction and properties of free boundary minimal surfaces via min-max

Abstract: A free boundary minimal surface (FBMS) in a three-dimensional Riemannian manifold is a critical point of the area functional with respect to variations that constrain its boundary to the boundary of the ambient manifold. It is natural to ask about the existence of FBMS (in a given ambient manifold) and their properties (topology, area, Morse index, etc.).

In this talk, we will analyze these questions through the lens of Simon-Smith variant of Almgren-Pitts min-max theory. More precisely, we will see how this method allows the construction of FBMS with prescribed properties (symmetry, topology, Morse index, etc.), by presenting new developments and discussing the limits and perspectives of this approach.

Speaker: Reto Buzano (Università degli studi di Torino)

Title: TBA

Abstract:

Speaker: Gerard Besson (Université Grenoble)

Title: TBA

Abstract: