

Workshop

Topics in Contemporary Differential Geometry

Workshop Program

Morning Section (19 August)	
9h00-10h00	Jean-Pierre Bourguignon (IHES, France) Spinors in 2023 from a Mathematician's Point of View
10h15-11h15	Shin-Ichi Ohta (Osaka, Japan) Geometry of weighted Finsler spacetimes
11h30-12h00	Gunhee Cho (UCSB, USA) Vanishing results from Lichnerowicz Laplacian on complete noncompact manifolds and applications
Afternoon Section (19 August)	
14h00-15h00	Richard Schoen (Stanford, USA) Stable minimal surfaces in higher codimension
15h15-16h15	Timothy Buttsworth (Queensland, Australia) Collapsing ancient Ricci flows with positive curvature operator
16h30-17h00	Nguyen Minh Hoang (VNU, Vietnam) Construction of minimal annuli in $\widetilde{\mathrm{PSL}}_2(\mathbb{R}, \tau)$ via a variational method

Invited talk

Tuesday (15 August)	
9h00-10h00	Christina Sormani (Lehman College and CUNYGC, USA) Integral Current Spaces and Intrinsic Flat Convergence

Titles and Abstracts

Spinors in 2023 from a Mathematician's Point of View

Jean Pierre Bourguignon

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Abstract

Spinors appeared in Mathematics in 1913 in classification work done by Élie Cartan. More than a century later, they are still objects that remain a bit mysterious to a number of mathematicians when their use is ubiquitous in Physics in relation with Quantum Mechanics.

After presenting the context, the lecture aims to review recent results concerning several questions in Differential Geometry to which spinors provided some important (and sometimes unexpected) clues.

Their impact comes often through the two differential operators one can define universally on spinor fields, namely the Dirac operator and the Penrose operator. A good example is provided by the concept of a Killing spinor field, which are special solutions of equations involving these two operators and have a very strong geometrical content.

Geometry of weighted Finsler spacetimes

Shin-ichi Ohta

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Abstract

This talk will be a review on the theory of weighted Lorentz-Finsler manifolds. A Lorentz-Finsler manifold is a generalization of a Lorentzian manifold in the same way that a Finsler manifold generalizes a Riemannian manifold. One can further equip a Lorentz-Finsler manifold with a time orientation as well as a weight, then we have a weighted Finsler spacetime. In this general framework, we can successfully develop the theory of Ricci curvature (singularity theorems, various comparison theorems, curvature-dimension condition, etc.). This talk is based on joint works with Mathias Braun, Yufeng Lu and Ettore Minguzzi.

Stable minimal surfaces in higher codimension

Richard Schoen

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Abstract

We discuss recent results on Bernstein-type theorems for stable minimal surfaces in high codimension. Many of the known results require that the surface be simply connected since they use refined properties of holomorphic vector bundles. We discuss new results in the genus 1 case and prospects for higher genus. We also give new Bonnet-Myers type results for minimal surfaces in strictly PIC manifolds.

Collapsing ancient Ricci flows with positive curvature operator

Timothy Buttsworth

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Abstract

The Ricci flow is one of the most widely-studied geometric evolution equations. Particularly relevant to the fields of geometry and topology are the solutions of the Ricci flow which have already existed for an infinite amount of time. These so-called ‘ancient Ricci flows’ have been the focus of sustained research efforts for decades. In this talk, I will discuss some classical examples of ancient Ricci flows, and also describe some more recent constructions of ancient Ricci flows that are geometrically collapsing as time goes backwards, and have positive curvature operator.

Short communications

Vanishing results from Lichnerowicz Laplacian on complete noncompact manifolds and applications

Gunhee Cho

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Abstract

We discuss several rigidity results for vanishing harmonic (p, q) -forms in complete noncompact manifolds. Our results are natural extensions of Petersen and Wink's results in the setting of complete, non-compact manifolds. The results on non-compact Kähler manifolds with parallel Bochner tensor or quaternion Kähler manifolds are based on the joint work with Nguyen Thac Dung, and general Riemannian case is based on the joint work with Nguyen Thac Dung and Tran Quang Huy.

Construction of minimal annuli in $\widetilde{\mathrm{PSL}}_2(\mathbb{R}, \tau)$ via a variational method

Nguyễn Minh Hoàng

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Abstract

We construct complete, embedded minimal annuli asymptotic to vertical planes in the Riemannian 3-manifold $\widetilde{\mathrm{PSL}}_2(\mathbb{R}, \tau)$. The boundary of these annuli consists of 4 vertical lines at infinity. They are constructed by taking the limit of a sequence of compact minimal annuli. The compactness is obtained from an estimate of curvature which uses foliations by minimal surfaces. This estimate is independent of the index of the surface. The difficulty of the construction comes from the lack of symmetry of the ambient space $\widetilde{\mathrm{PSL}}_2(\mathbb{R}, \tau)$.

This is joint work with Pascal Collin, and Laurent Hauswirth.

Invited talk

Integral Current Spaces and Intrinsic Flat Convergence

Christina Sormani

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Abstract

After reviewing Federer-Fleming's currents on Euclidean space and Ambrosio-Kirchheim's currents on metric spaces, we will introduce Integral Current Spaces as defined by Sormani-Wenger. We will then present intrinsic flat convergence of Riemannian manifolds and integral current spaces. For a bibliography see: <https://sites.google.com/site/intrinsicflatconvergence/>