SCHEDULE

Monday	Tuesday	Wednesday	Thursday	Friday
Malchiodi	Biquard	Chang	Daskalopoulos	Struwe
Tian	Del Pino	Yang	Wei	J. Li
Gursky	Rivière	*	Y. Li	*
Sesum	Druet	*	Wang	*
Guan	Sturm	*	*	*

The talks will take place in the Lecture Hall "Amphi Schwartz" located on the first floor of the 1R3 building.

Monday, June 10th

9am Registration

9 :30am Welcome speech

9 :40am - 10 :30am : A. Malchiodi

Coffee break

11am - 11 :50am : G. Tian

Buffet in hallway of 1R3 building

2pm - 2 :50pm : M. Gursky

Coffee break

3 :20pm - 4 :10pm : N. Sesum

4 :20pm - 5 :10pm : B. Guan

Tuesday, June 11th

9 :40am - 10 :30am : O. Biquard

Coffee break

11am - 11 :50am : M. Del Pino

Lunch at Restaurant l'Esplanade

2pm - 2 :50pm : T. Rivière

Coffee break

3 :20pm - 4 :10pm : O. Druet

4 :20pm - 5 :10pm : K.-T. Sturm

Wednesday, June 12th

9 :40am - 10 :30am : A. Chang

Coffee break

11am - 11 :50am : P. Yang

Lunch at Restaurant l'Esplanade

In the afternoon, we will offer a boat tour along the celebrated Canal du Midi followed by a guided walking tour of Toulouse.

Thursday, June 13th

9 :40am - 10 :30am : P. Daskalopoulous

Coffee break

11am - 11 :50am : J.-C. Wei

Lunch at Restaurant l'Esplanade

2pm - 2 :50pm : Y. Li

Coffee break

3 :20pm - 4 :10pm : G. Wang

Friday, June 14th

9 :40am - 10 :30am : M. Struwe

Coffee break

11am - 11 :50am : J. Li

Lunch at Restaurant l'Esplanade

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ABSTRACTS

Olivier Biquard

Renormalized volume for ALE Ricci-flat 4-manifolds

We introduce a renormalized volume for ALE Ricci-flat 4-manifolds, and prove that is satisfies an inequality, with equality only in the case of a cone. Joint work with Hans-Joachim Hein.

Alice Chang

Compactness of conformally compact Einstein manifolds in dimension 4

Given a class of conformally compact Einstein manifolds with boundary, we are interested to study the compactness of the class under some local and non-local boundary constraints. I will report some joint work with Yuxin Ge and Jie Qing including compactness results which are improvements of the earlier conditions obtained by Chang-Ge and compactness results under perturbation conditions when the L^2 norm of the Weyl curvature is small. As a by product, we will derive the global uniqueness of conformally compact Einstein metrics on the 4-Ball constructed in the earlier work of Graham-Lee.

Panagiota Daskalopoulos

Ancient solutions to Mean Curvature Flow and Ricci flow II

In the series of two talks (with N. Sesum) we will discuss recent progress on classification of ancient solutions in both, the mean curvature flow and the Ricci flow. We will talk about the uniqueness of two-convex, noncollapsed solutions to the mean curvature flow, in the sense they need to be either the spheres or the oval solutions that were constructed by White. The analogue of those solutions in the Ricci flow is the Perelman's solution. Perelman conjectured that shrinking spheres and those solutions are the only κ-solutions in 3 dimensions. We will discuss the resolution of this conjecture.

Manuel Del Pino

Infinite time singularity formation for the Keller-Segel system in $\mathbb{R}^2$

The classical model for chemotaxis is the planar Keller-Segel system

$$u_t = \Delta u - \nabla \cdot (u \nabla v), \quad v(\cdot, t) = \frac{1}{2\pi} \log |\cdot| * u(\cdot, t).$$

in $\mathbb{R}^2 \times (0, \infty)$. Blow-up of finite mass solution is expected to take place by aggregation, which is a concentration of bubbling type, common to many geometric flows. We build with precise profiles solutions in the critical-mass case 8π, in which blow-up in infinite time takes place. We establish stability of the phenomenon detected under arbitrary mass-preserving small perturbations.

Olivier Druet

Elliptic PDEs with Trudinger-Moser growth

We will study the simplest equation possible with a growth in e^{u^2} in a 2-dimensional domain. The aim is to obtain compactness results so as to deduce existence results at all energy levels. These are joint works with Andrea Malchiodi, Luca Martinazzi and Pierre-Damien Thizy.

Bo Guan

Fully nonlinear elliptic equations for conformal deformation of Chern-Ricci curvatures

There are several ways to define Chern-Ricci curvatures for the Chern connection on non-Kähler Hermitian manifolds. We introduce a notion of mixed-Chern-Ricci forms, which naturally occur in geometric problems and seem interesting to study, and consider fully nonlinear elliptic equations for their conformal deformation. We establish a priori estimates and prove existence results for these equations under very general structure conditions.

Our work is motivated by the close connections of these equations to problems in non-Kähler complex geometry, and the fact that there have been increasing interests in fully nonlinear pde's beyond the complex Monge-Ampere equation from complex Geometry. This talk is partially based on joint work with Chunhui Qiu and Rirong Yuan.

Matt Gursky

An index estimate for Yang-Mills in connections and an application to Einstein metrics

I will describe recent work with C. Kelleher and J. Streets in which we prove a conformally invariant estimate for Schrodinger operators acting on vector bundles over four-manifolds, based on the classical Cwikel-Lieb-Rozenblum estimate. As applications we give an estimate of the index of a Yang-Mills connection, and an estimate for the index for Einstein metrics in terms of the topology and the Einstein-Hilbert energy.

Jiayu Li

Canonical metrics on reflexive sheaves

We will first recall the stability of vector bundles and Donaldson-Uhlenbeck-Yau theorem. Then we will talk about Bando-Siu's generalization of the DUY theorem to reflexive sheaves, i.e. the existence of canonical metrics on reflexive sheaves. Finally we prove the Bando-Siu conjecture which are joint work with Xi Zhang and Chuanjing Zhang.

Yanyan Li

Existence and uniqueness of Green's function to a nonlinear Yamabe problem

For a given finite subset S of a compact Riemannian manifold $(M; g)$ whose Schouten curvature tensor belongs to a given cone, we establish a necessary and sufficient condition for the existence and uniqueness of a conformal metric on $M \setminus S$ such that each point of S corresponds to an asymptotically flat end and that the Schouten tensor of the new conformal metric belongs to the boundary of the given cone. This is a joint work with Luc Nguyen.

Andrea Malchiodi

On the Sobolev quotient in sub-Riemannian geometry

We consider a class of three-dimensional "CR manifolds" which are modelled on the Heisenberg group. We introduce a natural concept of "mass" and prove its positivity under the conditions that the Webster curvature is positive and in relation to their (holomorphic) embeddability properties. We apply this result to the CR Yamabe problem, and we discuss the properties of Sobolev-type quotients, giving some counterexamples to the existence of minimisers for "Rossi spheres", in sharp contrast to the Riemannian case. This is joint work with J.H.Cheng and P.Yang.

Tristan Rivière

Rellich-Kondrachov theorem for L^2-bounded curvatures

TBA.

Natasa Sesum

Ancient solutions to Mean Curvature Flow and Ricci flow I

In the series of two talks (with P. Daskalopoulos) we will discuss recent progress on classification of ancient solutions in both, the mean curvature flow and the Ricci flow. We will talk about the uniqueness of two-convex, noncollapsed solutions to the mean curvature flow, in the sense they need to be either the spheres or the oval solutions that were constructed by White. The analogue of those solutions in the Ricci flow is the Perelman's solution. Perelman conjectured that shrinking spheres and those solutions are the only κ-solutions in 3 dimensions. We will discuss the resolution of this conjecture.

Michael Struwe

Normalized harmonic map flow

Finding non-constant harmonic 3-spheres for a closed target manifold N is a prototype of a super-critical variational problem. In fact, the direct method fails, as the infimum of the Dirichlet energy in any homotopy class of maps from the 3-sphere to any closed N is zero; moreover, the harmonic map heat flow may blow up in finite time, and even the identity map from the 3-sphere to itself is not stable under this flow.

To overcome these difficulties, we propose the normalized harmonic map flow as a new tool, and we show that for this flow the identity map from the 3-sphere to itself now, indeed, is stable; moreover, the flow converges to a harmonic 3-sphere also when we perturb the target geometry.

While our results are strongest in the perturbative setting, we also outline a possible global theory.

Karl-Theodor Sturm

Gradient estimates for the Neumann heat flow on non-convex domains of metric measure spaces

We briefly recall the Eulerian and the Lagrangian approach to synthetic lower Ricci bounds on metric measure spaces due to Bakry-Emery and Lott-Sturm-Villani, resp., and present recent extensions to spaces with variable lower Ricci bounds. Our main

results will be a gradient estimate for the heat flow with Neumann boundary conditions on domains of metric measure spaces obtained through „convexification" of the domains by means of subtle time changes. This improves upon previous results both in the case of non-convex domains and in the case of convex domains.

Gang Tian

Kähler-Ricci flow on Fano manifolds

In this talk, I will first show some results on the regularity theory of Kähler-Ricci flow on Fano manifolds. Next I will discuss some recent progress, particularly, my joint work with Li and Zhu on limiting behavior of Kähler-Ricci flow. I may also discuss some open problems.

Guofang Wang

Free boundary hypersurfaces and Minkowski formulas

We first establish a new Minkowski formula for free boundary hypersurfaces in the unit ball and use it to completely solve the stablty problem of CMC free boundary hypersurfaces. Then using the Minkowski formula we introduce a inverse curvature type flow for free boundary hypersurfaces and prove the convergence. As an application, we establish Alexandrov-Fenchel inequalities for convex hypersurfaces with free boundary in a ball. The talk is based on the joint work with Chao Xia and also with Julian Scheuer.

Jun-Cheng Wei

$C^{2,\alpha}$-estimates of interfaces for Allen-Cahn equation

Consider the following question : Let u_ϵ be a sequence of solutions to

$$\epsilon \Delta u = \frac{1}{\epsilon}(u^3 - u)$$

in $B_1(0) \subset R^n$. Assume that the interfaces $\{u_\epsilon = 0\}$ converges in $C^{1,\alpha}$. Does it converge in $C^{2,\alpha}$? We show that the obstruction to $C^{2,\alpha}$ convergence is the existence of Toda system (and hence collapsed interfaces). Then we give a confirmative answer in dimensions $n \leq 10$, (which is optimal). We show two applications of this convergence : the first is the classification of finite Morse index solutions in R^2; and the second is the classification of axially symmetric solutions in higher dimensions. (Joint work with K. Wang)

Paul Yang

Extensions of an inequality of Gursky

I plan to discuss a couple of extensions of the Gursky inequality about a sharp upper bound for the total Q-curvature integral in dimension four. The first extension is to the case of 4-manifold with boundary. The second one deals with an analogous inequality in CR geometry of real dimension three.

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