BAY AREA DIFFERENTIAL GEOMETRY SEMINAR
PACIFIC NORTHWEST GEOMETRY SEMINAR

FEBRUARY 4-5, 2012
STANFORD UNIVERSITY
Department of Mathematics
Room 380-W

David Bao (San Francisco State University), Robert Bryant (Mathematical Sciences Research Institute), Joel Hass (University of California, Davis), David Hoffman (Stanford University), Rafe Mazzeo (Stanford University), Richard Montgomery (University of California, Santa Cruz)

The Bay Area Differential Geometry Seminar meets three times each year and is a one-day seminar on recent developments in differential geometry and global analysis, broadly interpreted. The February meeting at Stanford is a joint meeting with the Pacific Northwest Geometry Seminar, and will be a two-day event. It will conclude with a banquet dinner that will be subsidized for students and postdocs. Please use the DINNER SIGNUP FORM to register for the seminar and to indicate whether or not you will attend the banquet. Spouses and significant others are invited to the dinner. Problems? Email *hoffman@math.stanford.edu*. This year the geometry seminar will occur on the same weekend as a conference on Lie Theory and Quantum Groups also meeting at Stanford.

The Maps and Direction Page will help you get to Stanford. The department is located on the northwest corner of the Main Quad on the Stanford University Campus in Building 38, Room 380W. The campus map and the mathematics department map will help you find the meeting. Parking is unrestricted on the weekends.

Saturday, February 4

10:00 AM *Reception. Coffee and rolls*

10:30 AM Richard Bamler, Stanford
Long-time analysis of 3-dimensional Ricci Flow

11:30 AM Francisco Martin, Granada
Properly Embedded area-minimizing surfaces in hyperbolic 3-space

12:30 PM *Lunch (There are many places to eat on the Campus and in Palo Alto)*

1:45 PM *Business meeting*

2:00 PM Nicos Kapouleas, Brown University
Gluing Constructions for minimal surfaces and self-shrinkers

3:00 PM *Afternoon Coffee and Cake*

3:45 PM Yanir Rubinstein, Stanford
Einstein Metrics on Kahler Manifolds

6:00 PM *Banquet (Jade Palace, South California Avenue, Palo Alto)*

Sunday, February 5

9:30AM *Reception. Coffee and rolls*

10:00AM Jeff Streets, UC Irvine
The gradient flow of the L^2 curvature energy

11:00AM Jeff Viaclovsky, Wisconsin
Asymptotics of the self-dual deformation complex

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Joint Meeting at Stanford University
February 4-5, 2012

Richard Bamler, Stanford

Long-time analysis of 3 dimensional Ricci flow

Abstract. It is still an open problem how Perelman's Ricci flow with surgeries behaves for large times. For example, it is unknown whether surgeries eventually stop occurring and whether the geometric decomposition is exhibited by the flow as $t \to \infty$.

In this talk, I will present new tools to treat this question. Moreover, I will give a thorough analysis under the pure topological condition that the initial manifold only has hyperbolic or non-aspherical components in its geometric decomposition (i.e. prime and torus-decomposition). It will turn out that in this case, surgeries do in fact stop occurring after some time and the curvature is globally bounded by Ct^{-1}. Finally, I will explain how to treat more general cases.

Nicos Kapouleas, Brown University

Gluing constructions for minimal surfaces and self-shrinkers

Abstract. In the first part of the talk I will discuss doubling constructions. In particular I will discuss technical aspects of recent doubling constructions for an equatorial two-sphere in the round three-sphere, and also potential generalizations to higher dimensions and constructions for self-shrinkers of the Mean Curvature Flow. In the second part of the talk I will briefly discuss the current understanding of desingularisation constructions for minimal surfaces and self-shrinkers. In the third and final part I will discuss open uniqueness questions for closed embedded minimal surfaces in the round three-sphere inspired by the above constructions.

Francisco Martin, University of Granada, Spain

Properly embedded area-minimizing surfaces in hyperbolic three-space.

Abstract. We prove that, given S an open oriented surface, then there exists a complete, proper, area minimizing embedding $f : S \to H^3$. The main tool in the proof of the above result is a sort of bridge principle at infinity for properly embedded area minimizing surfaces in hyperbolic three space. This is a joint work with Brian White.

Yanir Rubinstein, Stanford

Einstein Metrics on Kahler Manifolds

Abstract. The Uniformisation Theorem implies that any compact Riemann surface has a constant curvature metric. Kahler-Einstein (KE) metrics are a natural generalization of such metrics, and the search for them has a long and rich history,

going back to Schouten, Kahler (30's), Calabi (50's), Aubin, Yau (70's) and Tian (90's), among others. Yet, despite much progress, a complete picture is available only in complex dimension 2.

In contrast to such smooth KE metrics, in the mid 90's Tian conjectured the existence of KE metrics with conical singularities along a divisor (i.e., for which the manifold is 'bent' at some angle along a complex hypersurface), motivated by applications to algebraic geometry and Calabi-Yau manifolds. More recently, Donaldson suggested a program for constructing smooth KE metrics of positive curvature out of such singular ones, and put forward several influential conjectures.

In this talk we will try to give an introduction to Kahler-Einstein geometry and briefly describe some recent work mostly joint with R. Mazzeo that resolves some of these conjectures. One key ingredient is a new $C^{2,\alpha}$ *a priori* estimate and continuity method for the complex Monge-Ampere equation. It follows that many algebraic varieties that may not admit smooth KE metrics (e.g., Fano or minimal varieties) nevertheless admit KE metrics bent along a simple normal crossing divisor.

Jeff Streets, UC Irvine

The gradient flow of the L^2 curvature energy

The L^2 norm of the Riemannian curvature tensor is a natural intrinsic analogue of the Yang-Mills energy in purely Riemannian geometry. To understand the structure of this functional, it is natural to consider the gradient flow. I will give an overview of the analytic theory behind this flow, and discuss some long time existence results in low dimensions. Finally I will mention some natural conjectures for this flow and their consequences.

Jeff Viaclovsky, University of Wisconsin

Asymptotics of the self-dual deformation complex

I will analyze the indicial roots of the self-dual deformation complex on a cylinder $(\mathbb{R}\times Y^3, dt^2+g_Y)$, where Y^3 is a space of constant curvature. An application is the optimal decay rate of solutions on a self-dual manifold with cylindrical ends having cross-section Y^3. I will also discuss the resolution of a conjecture of Kovalev-Singer in the case where Y^3 is a hyperbolic rational homology 3-sphere, and show that there are infinitely many examples for which the conjecture is true, and infinitely many examples for which the conjecture is false. Applications to gluing theorems are also discussed. This is joint work with Antonio Ach