Talk Schedule

(Ungar 402, University of Miami)

Saturday morning, Nov 16	
9:00 – 9:25	Morning Coffee
9:30 – 10:15	Philippe LeFloch *Constructing classes of solutions to the Einstein equations with tame decay*
10:30 – 11:15	Marcus Khuri *Geometric inequalities for quasi-local masses*
11:30 – 12:15	Franco Vargas Pallete *Bounds on renormalized volume for Schottky manifolds*

Saturday afternoon, Nov 16	
14:00 – 14:45	Daren Cheng *Instability of solutions to the Ginzburg–Landau equation on S^n and CP^n*
15:00 – 15:45	David Wiygul *Mass estimates for static vacuum metrics with small Bartnik boundary data*
15:45 – 16:15	Coffee Break
16:15 – 17:00	Christos Mantoulidis *Capacity and quasi-local mass*

Sunday morning, Nov 17	
9:00 – 9:30	Morning Coffee
9:30 – 10:15	Dan Lee *Lower semicontinuity of ADM mass*
10:30 – 11:15	Po-Ning Chen *Quasi-local mass and Penrose inequality*
11:30 – 12:15	Daniel Stern *Scalar curvature and harmonic functions*

Sunday afternoon, Nov 17	
14:00 – 14:45	Demetre Kazaras *A new proof of the* $3d$ *positive mass theorem*
15:00 – 15:45	Sven Hirsch *Mass of manifolds with boundary and an isoperimetric inequality*
15:45 – 16:15	Coffee Break
16:15 – 17:00	Hyun Chul Jang *Some scalar curvature warped product splitting theorems*
17:15 – 18:00	Jintian Zhu *Area minimizing 2-spheres in n-manifolds with positive scalar curvature*

Title and Abstracts

Philippe LeFloch (Sorbonne University)

Title: Constructing classes of solutions to the Einstein equations with tame decay

Abstract. The Seed-to-Solution Method (in a joint work with T. Nguyen, Paris) provides us with a new approach for analyzing Einstein?s constraint equations and leads to the existence of asymptotically Euclidean manifolds with prescribed asymptotics and quantative (error) estimates. By distinguishing between "tame" or "strongly tame" data, we encompass metrics with the weakest possible decay (infinite ADM mass) or the strongest possible decay (Schwarzschild behavior). Our approach, motivated by Carlotto and Schoen?s pioneering work (on the optimal localization problem) requires to establish sharp (critical) decay estimates for the (linearized, elliptic) Einstein operator. Second, we introduce the "asymptotic localization" problem as we call it, and also we solve this problem at the critical level of decay. Third, in a joint work with Yue Ma (Xi'an) the global evolution of such initial data sets is analyzed via a new vector-field method for the Einstein equations, which we call the Euclidian-hyperboloidal Foliation Method.

Blog: philippelefloch.org

Marcus Khuri (Stony Brook University)

Title: Geometric Inequalities for Quasi-Local Masses

Abstract: We will describe lower bounds for quasi-local masses in terms of charge, angular momentum, and horizon area. In particular we treat three quasi-local masses based on a Hamiltonian approach, namely the Brown-York, Liu-Yau, and Wang-Yau masses. The geometric inequalities are motivated by analogous results for the ADM mass. They may be interpreted as localized versions of these inequalities, and are also closely tied to the conjectured Bekenstein bounds for entropy of macroscopic bodies. In addition, we give a new proof of the positivity property for the Wang-Yau mass which is used to remove the spin condition in higher dimensions. Furthermore, we generalize a recent result of Lu and Miao to obtain a localized version of the Penrose inequality for the static Wang-Yau mass. This is joint work with A. Alaee and S.-T. Yau.

Franco Vargas Pallete (Yale University)

Title: Bounds on renormalized volume for Schottky manifolds

Abstract: During the talk I will introduce renormalized volume for convex co-compact hyperbolic 3-manifolds and will also describe bounds for Schottky manifolds in term of extremal lengths in the conformal surface at infinity. This will be used to partially answer a question by Maldacena about comparing renormalized volume for Schottky and Fuchsian manifolds with the same conformal boundaries.

Daren Cheng (University of Chicago)

Title: Instability of solutions to the Ginzburg–Landau equation on S^n and CP^n

Abstract: Motivated by the relationship between codimension two minimal submanifolds and Ginzburg–Landau (GL) type functionals, we study the latter on S^n and CP^n, both equipped with their standard metrics, and establish some analogues of the classical results of Simons and Lawson–Simons. In particular, for the GL functional without magnetic field, we prove that stable critical points on S^n or CP^n must be constants. Moreover, when the parameter is small, we show that critical points on S^n satisfy the same index lower bound as minimal $(n-2)$-submanifolds.

David Wiygul (California State University, Fullerton)

Title: Mass estimates for static vacuum metrics with small Bartnik boundary data

Abstract: I will report on recent elaboration of older work to estimate the mass of static vacuum extensions with boundary metric and mean curvature close to those of the standard unit sphere in Euclidean space.

Christos Mantoulidis (MIT)

Title: Capacity and quasi-local mass

Abstract: (Joint work with P. Miao and L.-F. Tam.) We derive new inequalities between the boundary capacity of an asymptotically flat 3-manifold with nonnegative scalar curvature and boundary quantities that relate to quasi-local mass; one relates to Brown-York mass and the other is new. Among other things, our work yields new variational characterizations of Riemannian Schwarzschild manifolds and new comparison results for surfaces in them.

Dan Lee, Queens College, CUNY

Title: Lower semicontinuity of ADM mass

Abstract: Jauregui proved that the ADM mass of asymptotically flat manifolds with nonnegative scalar curvature is lower semicontinuous under pointed C^2 convergence. I will discuss joint work with Jauregui that weakens the hypothesis to pointed C^0 convergence. The proof uses Huisken?s isoperimetric mass concept and mean curvature flow. The proof is robust enough that we were recently able to improve the result further to handle an even weaker form of convergence called intrinsic flat volume convergence.

Po-Ning Chen, University of California Riverside

Title: Quasi-local mass and Penrose inequality

Abstract: The positive mass theorem is one of the fundamental results in general relativity. It states that the total mass of asymptotically flat spacetime is non-negative. The Penrose inequality provides a lower bound on mass by the area of the black hole and is closely related to the cosmic censorship conjecture in general relativity. Recently, Lu and Miao proved a quasi-local Penrose inequality for the quasi-local energy with reference in the Schwarzschild manifold. In this article, we prove a quasi-local Penrose inequality for the quasi-local energy with reference in any spherically symmetric static spacetime.

Daniel Stern (University of Toronto)

Title: Scalar curvature and harmonic functions

Abstract: I will discuss an intriguing connection between scalar curvature and the level sets of (circle-valued) harmonic functions on a given manifold, based on a reinterpretation of the classical Bochner identity for harmonic one-forms. I'll describe several applications to the study of scalar curvature on compact three-manifolds with and without boundary, including geometric characterizations of the Thurston norm in terms of scalar curvature and boundary mean curvature. These methods also play a role in a new proof (joint with Bray, Kazaras, and Khuri) of the three-dimensional positive mass theorem, providing a family of explicit lower bounds on the ADM mass.

Demetre Kazaras, Stony Brook University

Title: A new proof of the 3d Positive Mass Theorem

Abstract: In this talk I will describe a new and relatively simple proof of the Riemannian Positive Mass Theorem in dimension 3, which is joint work with Hugh Bray, Marcus Khuri, and Daniel Stern. The central objects we analyse are level sets of asymptotically linear harmonic functions, geometrically fitting somewhere between the harmonic spinors of Witten's proof and the minimal surfaces of the original Schoen-Yau proof. An integration formula previously developed by Daniel Stern plays a key role.

Sven Hirsch (Duke University)

Title: Mass of manifolds with boundary and an isoperimetric inequality

Abstract: The aim of this talk is twofold: First, we are discussing several results in the literature on the mass of asymptotically flat manifolds with non-negative scalar curvature depending on various conditions of the geometry of the boundary, including a recent paper joint with Pengzi Miao. Second, we show how an adaption of the minimal surface technique can lead to sharp isoperimetric inequalities of certain positively curved manifolds.

Hyun Chul Jang (University of Connecticut)

Title: Some scalar curvature warped product splitting theorems

Abstract: In this talk, we will present several splitting theorems for Riemannian manifolds (M^n, g) with scalar curvature $S \geq -n(n-1)$ or $S \geq 0$, and having compact boundary N satisfying mean curvature inequality. The proofs make use of results on marginally outer trapped surfaces applied to appropriate initial data sets. One of the results involves an analysis of Obata's equation on manifolds with boundary. We will briefly discuss how this result can be related to the rigidity of asymptotically locally hyperbolic manifolds with zero mass. This talk is based on the joint work with G. Galloway.

Jintian Zhu, University of Chicago

Title: Area minimizing 2-spheres in n-manifolds with positive scalar curvature

Abstract: We prove a sharp upper bound for the least area of non-contractible 2-spheres in a class of n-manifolds with positive scalar curvature. This can be view as a generalization of a result by Bray, Brendle and Neves.