G.A.S.B.A.G.S Abstracts

November 6–7, 2021

Saturday, November 6

David Jerison (MIT): Geometry of Level Sets

Tang-Kai Lee (MIT): Self-shrinkers and Entropy Minimizers for the Mean Curvature Flow

Abstract: The analysis of self-shrinkers plays an important role in the study of the mean curvature flow. Among many invariants of self-shrinkers, entropy is a natural geometric quantity measuring the complexity of a self-shrinker. In this talk, we will survey some rigidity results of hypersurface self-shrinkers in terms of entropy, and see an attempt toward the higher-codimension case.

Jie Xu (Boston University): Yamabe Problem in Various Domains

Abstract:In this talk, I will discuss the prescribed constant scalar curvature λ under pointwise conformal change $\tilde{g} = e^{2f}g = u^{p-2}g$. It is equivalent to find out a real, positive, smooth solution of the nonlinear elliptic PDE

$$\frac{4(n-1)}{n-2}\Delta_g u + S_g u = \lambda u^{\frac{n+2}{n-2}}$$

I will discuss the results (i) in a small Riemannian domain (Ω, g); (ii) on closed manifolds; (iii) on compact manifolds with smooth boundary. In contrast to the classical methods by global analysis in calculus of variation, due to Aubin, Escobar, Trudinger, Schoen, Yamabe, etc, I will discuss how to apply local analysis and iterative methods to obtain the solvability of Yamabe equation directly in different cases associated with different boundary conditions (if necessary). Some results above are due to a joint work with my advisor S. Rosenberg.

Ruoxuan Yang (MIT): Shock formations for the Burgers-Hilbert equation

Abstract: We will talk about shock formations for the Burgers–Hilbert (BH) equation. We begin with previous studies on BH equation. Then we introduce the technique of modulated self-similarity and apply it to the BH equation. The obtained shock formations will be asymptotically self-similar. We will focus on the stable shock solution but we will outline the steps to find unstable shock solutions.

Maxim Jeffs (Harvard): Symplectic geometry of singular varieties

Abstract: While smooth affine and projective varieties are symplectic manifolds, there are many reasons why one also needs to study the symplectic geometry of singular varieties. I'll explain some of these reasons coming from mirror symmetry and give an overview of different approaches for making sense of symplectic constructions for singular spaces. I'll finish by describing some work in progress on Fukaya categories of singular complete intersections.

Sunday, November 7

Paul Seidel (MIT): Fukaya categories of Calabi-Yau hypersurfaces (I + II)

Abstract: The Fukaya category is a basic algebraic objects encoding Lagrangian submanifolds and pseudo-holomorphic curves in a given symplectic manifold. It's really a family of categories, depending on a formal parameter q (the "Kaehler area" or "Novikov" parameter). The first talk is relatively introductory: I will explain some aspects of the (relative) Fukaya category, the role of vanishing cycles, and finally, the homological algebra concepts of A_∞-bimodule and of noncommutative divisor. The second talk will dig more deeply into what we know about q-dependence. Generally, I think it will be very helpful if you have met the Fukaya category at least informally before the talks: Auroux' paper "A beginner's introduction to Fukaya categories" is recommended as background reading.

Yuqiu Fu (MIT): Decoupling Inequalities in Fourier Analysis

Abstract: In the late 90s, Thomas Wolff introduced and studied decoupling inequalities in Fourier analysis and proposed a conjecture. The full conjecture was solved by Bourgain and Deme- ter in 2014, which was ground-breaking and has led to a recent rapid development of decoupling. In this talk we will first

introduce what decoupling is, and describe some decoupling in- equalities with applications to analysis and number theory. We will also discuss some ideas in the proof of decoupling by looking at a special case of decoupling for the parabola.

Xuezhu Lu (Northeastern): Inverse problems for nonlinear time-harmonic Maxwell's equations with partial data.

Abstract: Inverse boundary value problems (IBVP) was first proposed by Calderón for a proposed imaging method, known as the electrical impedance tomography, in which one aims to determine the electrical conductivity from the boundary measurements (Dirichlet-to-Neumann map) of the electric voltage and current. Partial data inverse problems are also formulated when the boundary measurements are available only on a subset of the boundary in applications. When dealing with IBVPs of nonlinear elliptic PDEs, the higher order linearization of the nonlinear DN map works as a powerful tool. In this talk, I will first consider the inverse problem of determining the uniqueness of nonlinear coefficient for some Helmholtz type Schrödinger with partial boundary measurements. I will then consider the partial data inverse problem for nonlinear time-harmonic Maxwell's system of Kerr-type media and with second harmonic generation.

Feng Gui (MIT): Harmonic and Caloric Functions of Polynomial Growth.

Abstract: In 1970s, S.T. Yau generalized the classical Liouville theorem to the setting of manifolds with non-negative Ricci curvature. A stronger Liouville property concerning harmonic functions with certain growth conditions was proved by Colding and Minicozzi. In this talk, we will revisit these Liouville-type theorems, and discuss recent progresses for harmonic and caloric functions with polynomial growth and their applications in mean curvature flow and Ricci flow.