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

October 29–30, 2022

Saturday, October 29

Sarah Tammen (MIT): Incidence Estimates for Slabs

Abstract: We discuss incidence estimates for neighborhoods of hyperplanes in $\mathbb{R}^n$, after the work of Guth, Solomon, and Wang, who proved an analogue of the Szemerédi-Trotter theorem to estimate incidences of tubes. We use induction on scales and the high-low method of Vinh along with new geometric insights.

Gonzalo Cao-Labora (MIT): Smooth imploding solutions for 3D compressible fluids

Abstract: We will talk about singularity formation for the 3D isentropic compressible Euler and Navier-Stokes equations for ideal gases. These equations describe the motion of a compressible ideal gas, which is characterized by a parameter called adiabatic constant. Finite time singularities for generic adiabatic constants were found in the recent work of Merle, Raphaël, Rodnianski and Szeftel. This is done via a stability analysis around the smooth self-similar profiles for generic adiabatic constants.

We will drop the genericity assumption and construct smooth self-similar profiles for all values of the adiabatic constant. In particular, we will construct the first smooth self-similar profile for a monoatomic gas. We also present a different stability analysis around those profiles that allows to show singularity formation for initial data with constant density at infinity. These results are joint work with Tristan Buckmaster and Javier Gomez-Serrano.

Tainara Borges (Brown University): Sparse Domination for Bilinear Spherical Maximal Function

Abstract: In this talk, we introduce the concept of sparse domination and discuss the work of Lacey in the sparse domination for the Spherical Maximal Function. We will then talk about some attempts of bringing sparse domination to the world of multilinear Radon type operators and a joint work with B. Foster, Y. Ou, J. Pipher, and Z. Zou, in which we proved sparse domination results for a bilinear generalization of the spherical maximal function. Namely, the maximal operator given by

$$\mathcal{M}(f,g)(x) = \sup_{t>0} \int_{S^{2d-1}} |f(x-ty)g(x-tz)|\, d\sigma(y,z),\ x \in \mathbb{R}^d,$$

in any dimension $d \geq 2$. Such sparse domination allows one to recover the known sharp $L^p \times L^q \to L^r$ bounds for the operator and to deduce new quantitative weighted norm inequalities with respect to bilinear Muckenhoupt weights. The key innovation is a group of newly developed continuity L^p improving estimates for the localized version of the bilinear spherical maximal function.

Andrew Lawrie (MIT): The soliton resolution conjecture for equivariant wave maps

Abstract: I will present a joint work with Jacek Jendrej (CRNS, Sorbonne Paris Nord) on equivariant wave maps with values in the two-sphere. We prove that every finite energy solution resolves, as time passes, into a superposition of harmonic maps (solitons) and radiation, settling the soliton resolution problem for this equation. It was proved in works of Côte, and Jia-Kenig, that such a decomposition holds along a sequence of times. We show the resolution holds continuously-in-time via a "no-return" lemma based on the virial identity. The proof combines a modulation analysis of solutions near a multi-soliton configuration with concentration compactness techniques. As a byproduct of our analysis we prove that there are no pure multi-solitons in equivariance class k=1 and no elastic collisions between pure multi-solitons in the higher equivariance classes.

Xinrui Zhao (MIT): Unique continuation problem on RCD spaces

Abstract: In this talk we will sketch the proof of the unique continuation property of harmonic functions and caloric functions on any $RCD(k,2)$ spaces and a counterexample for the strong unique continuation property of harmonic functions on an $RCD(k,4)$ space. This characterizes one of the significant differences between RCD spaces and smooth manifolds. We will also talk about some related open problems. The talk is based on joint works with Qin Deng.

Sunday, October 30

Semyon Dyatlov (MIT): Dynamical Zeta Functions (I + II)

> **Abstract**: The topic of this course is Pollicott-Ruelle resonances for Anosov flows, which are strongly chaotic systems; an example of an Anosov flow is the geodesic flow on a compact negatively curved Riemannian manifold. Pollicott-Ruelle resonances appear in two ways: as complex characteristic frequencies in long time asymptotics of correlations and as zeros and poles of dynamical zeta functions defined from the lengths of closed trajectories. I will give a "big picture" overview of the microlocal approach to Pollicott-Ruelle resonances, focusing on general ideas rather than the details of the proofs. In particular I will discuss ergodicity, exponential mixing, and relation of dynamical zeta functions to topology.

Tina Torkaman (Harvard): Intersection number and intersection points of closed geodesics on hyperbolic surfaces

> **Abstract**: In this talk, I will talk about the (geometric) intersection number between closed geodesics on finite volume hyperbolic surfaces. Specifically, I will discuss the optimum upper bound on the intersection number in terms of the product of hyperbolic lengths. I also talk about the equidistribution of the intersection points between closed geodesics.

Ian Montague (Brandeis): Seiberg-Witten Floer K-Theory and Cyclic Group Actions on Spin 4-Manifolds with Boundary

> **Abstract**: Given a spin rational homology sphere Y equipped with a $\mathbb{Z}/m$-action preserving the spin structure, I will outline how to define equivariant refinements of Manolescu's kappa invariant. These invariants give rise to equivariant relative 10/8-ths type inequalities for $\mathbb{Z}/m$-equivariant spin cobordisms between rational homology spheres. I will explain how these inequalities provide applications to knot concordance, give obstructions to extending cyclic group actions to spin fillings, and via taking branched covers give us genus bounds for knots in punctured 4-manifolds. If time permits I will explain how these invariants are related to equivariant eta-invariants of the Dirac operator, and outline how to obtain explicit formulas for the S^1-equivariant eta-invariants on Seifert-fibered spaces associated to the S^1-action given by rotation in the fibers.

Ju Tan (Boston University): Mirror Symmetry for Quiver Algebroid Stack

Abstract: Quiver has a rich representation theory. There are gorgeous connections between quiver representations and sheaves. In this talk, we will introduce the quiver algebroid stack and an associated functor from a symplectic manifold, which enables us to understand these deep relations in terms of Mirror Symmetry. We will also introduce some interesting applications of this construction.