Abstracts Week 5

Speaker: Gao Chen

Abstract: In this talk, we survey three problems concerning hyper-Kähler 4-manifolds with finite energy:

1. The asymptotic structures at infinity.
2. The Torelli-type theorems.
3. Their relationship with the moduli space of the dimension reductions of anti-self-dual instantons."

Speaker: Mingyang Li

Abstract: Poincare-Einstein manifolds are important objects in geometric analysis and mathematical physics, while constructing them beyond the perturbative method remains challenging. In this talk, I will present a large-scale, non-perturbative construction that yields infinite-dimensional families of such manifolds in the presence of complex geometric structures. The approach reduces the Einstein equation to a Toda-type system, essentially due to ansatz by LeBrun and Tod. Joint work with Hongyi Liu.

Speaker: Lan-Hsuan Huang

Abstract: We address two problems concerning ADM mass minimizing initial data sets: the equality case of the positive mass theorem and the resolution of Bartnik's 1989 stationary vacuum conjecture. A key new ingredient is a monotonicity formula for the Lorentzian length of a causal Killing vector field. This is joint work with Sven Hirsch based on the paper https://arxiv.org/abs/2510.10306.

Speaker: Qi Yao

Abstract: The Homogeneous Complex Monge-Ampère (HCMA) equation plays a central role in Kähler geometry, effectively describing geodesics in the space of Kähler metrics. A major open question concerns the regularity of weak solutions to this equation.

In this talk, I will present a new local higher regularity result for the HCMA equation on complete Kähler manifolds. The proof relies on constructing a local foliation of the space by holomorphic discs and redeveloping the global pluripotential theory. I will point out a subtle regularity issue in the parameter dependence of these foliations and show how to resolve it using a Nash-Moser technique. By constructing a global plurisubharmonic subsolution, I will show that the local solution determined by the foliation agrees exactly with the global $C^{1,1}$ solution. As an application, I will discuss the consequences of this regularity on the ALE end.