Mass in General Relativity Schedule

Events for:
Monday, March 26th - Friday, March 30th

Monday, March 26th

10:00am **R Schoen - SCGP 102**

Title: Positive Mass Theorem in All Dimensions

11:30am **Lunch - Cafe**

1:00pm **L-H Huang - SCGP 102**

Title: Rigidity of the Positive Mass Theorem

2:30pm **P-N Chen - SCGP 102**

Title: Quasi-local mass with reference in the static spacetimes and the rigidity of surfaces in the Schwarzschild manifold.

3:30pm **C Sormani - SCGP 102**

Title: Spacetime Intrinsic Flat Convergence and Mass

4:00pm **Tea**

4:30pm **Mass in General Relativity: Public Lecture of Professor Shing-Tung Yau - SCGP 103**

Title: Geometry of spacetime and mass in general relativity

Abstract: I shall discuss the role of geometry in creating the space time that is fundamental to the physics of general relativity. I shall also discuss fundamental concepts such as mass, linear momentum and angular momentum in general relativity. The lack of continuous symmetries in general spacetime makes it difficult to define such quantities and I shall explain how the difficulty can be overcome by the works of Brown-York, Liu-Yau and Wang -Yau.

Tuesday, March 27th

10:00am **A Carlotto - SCGP 102**

      Title: Einstein constraint equations: old and new

11:00am **Coffee Break - Cafe**

11:30am **X Zhou - SCGP 102**

      Title: Min-max theory for constant mean curvature (CMC) hypersurfaces

12:00pm **Lunch - Cafe**

1:00pm **P Chrusciel - SCGP 102**

      Title: The mass of asymptotically hyperbolic manifolds

2:30pm **O Chodosh - SCGP 102**

      Title: Minimal surfaces in asymptotically flat 3-manifolds

3:30pm **Tea**

4:00pm **Y-S Cha - SCGP 102**

Title: Geometric Inequalities for Near Maximal Axially Symmetric Initial Data

5:15pm   **M T Wang - SCGP 102**

Title: Quasilocal mass and isometric embedding

Wednesday, March 28th

10:00am **M Herzlich - SCGP 102**

Title: Universal positive mass theorems

11:00am **Coffee Break - Cafe**

11:30am **S Lu - SCGP 102**

Title: Minimal hypersurface and boundary behavior of a compact manifold

12:00pm **Lunch - Cafe**

1:00pm   **M Khuri - SCGP 102**

Title: Stationary Vacuum Black Holes in 5 Dimensions

2:30pm   **P LeFloch - SCGP 102**

Title: Nonlinear stability of self-gravitating massive matter

3:30pm   **Tea**

4:00pm   **H Roesch - SCGP 102**

Title: Null Geometry and the Penrose Conjecture

Abstract: In the first half of the talk, we introduce a new quasi-local mass with interesting properties along null flows off of a 2-sphere in spacetime or, equivalently, foliations of a null cone. We also show how certain convexity assumptions on the null cone allows for a proof of the Penrose Conjecture. On the Black Hole Horizon, we find that this convexity assumption becomes sharp; therefore, the second half of the talk will explore the existence of a class of Black Hole Horizons satisfying the convexity assumptions even up to a small perturbation. A consequence of which, building upon the work of S. Alexakis, is that the Schwarzschild Null Cone--the case of equality for the Penrose Conjecture--is critical.

5:15pm **L Nguyen - SCGP 102**

Title: Deformation of mass aspect function and positive energy for asymptotically hyperbolic manifolds

Thursday, March 29th

10:00am **C Mantoulidis - SCGP 102**

Title: positive scalar curvature with singularities.

11:30am **D Kazaras - SCGP 102**

Title: Minimal hypersurfaces with free boundary and positive scalar curvature bordism

12:00pm **Lunch - Cafe**

1:00pm **P Miao - SCGP 102**

Title: A connection between Bartnik mass and Wang-Yau quasi-local mass

Abstract: We discuss some recent observation that ties the Bartnik mass to the generalized Wang-Yau quasi-local energy with respect to static spaces. More precisely, given a family of closed 2-surfaces $\{\Sigma_t\}$ evolving in a 3-manifold of nonnegative scalar curvature, if the reference static space of the generalized Wang-Yau quasi-local energy is a minimal mass extension of Σ_0, we observe that the derivative of the quasi-local energy of Σ_t at Σ_0 agrees with the derivative of the Bartnik mass of Σ_t at Σ_0. We also discuss its implication to the rigidity case of a localized Penrose inequality. This talk is based on joint work with Siyuan Lu.

2:30pm **A Burtscher - SCGP 102**

Title: "A generalized notion of ADM mass for static perfect fluids"

3:30pm **Tea**

4:00pm **I Stavrov - SCGP 102**

Title: Relating relativistic point sources to continuous matter distributions

Abstract: Due to linearity of the Poisson equation one can describe a Newtonian gravitational point source as a limit of continuous matter distributions, and vice versa: one can view a continuous matter distribution as a limit of a sequence of point source configurations. In general relativity this idea is much more difficult to implement because the Einstein equations are non-linear. In this talk we present a mathematically rigorous way of executing these ideas at the level of time-symmetric initial data. The key is to pay special attention to (self-)interaction energies of point sources and to use intrinsic flat limit developed by Sormani and Wenger. This work is a collaboration with Noah Benjamin and Tatyana Benko.

5:15pm **Yu Li - SCGP 102**

Title: Ricci flow on asymptotically Euclidean manifolds

6:30pm **B Allen - SCGP 102**

Title: Stability of the PMT and RPI using IMCF

Friday, March 30th

10:00am A Ashtekar - SCGP 102

Title: Gravitational waves: Interplay between physics and geometry.

11:00am Coffee Break - Cafe

11:30am B Bonga - SCGP 102

Title: A geometric framework for cosmological spacetimes

12:00pm Lunch - Cafe

1:00pm J Jauregui - SCGP102

Title: Minimizers of Bartnik's quasi-local mass.

2:30pm A Cabrera - SCGP 102

Title: Extensions of Riemannian manifolds and Bartnik mass estimates

Abstract: Recently, C. Mantoulidis and R. Schoen constructed asymptotically flat extensions with controlled ADM mass of Bartnik data $\mathcal{B} = (\S \cong \mathbb{S}^2,g,H=0)$, where g is a metric satisfying $\lambda_1(-\Delta_g + K(g)) > 0$ and $K(g)$ denotes the Gauss curvature of g. In particular, they used these extensions to show that the Bartnik mass of $\mathcal{B}$ equals the optimal value in the Riemannian Penrose inequality. In this talk, we will present some results involving Bartnik mass estimates that were inspired by their construction. This talk is based on joint works with C. Cederbaum, S. McCormick and P. Miao.

3:30pm Tea

4:00pm D L Ambrozio - SCGP 102

Title: Minimal hypersurfaces with free boundary and positive scalar curvature bordism

5:00pm C LeBrun - SCGP 102

Title: Mass in Kaehler Geometry

Abstract: Asymptotically locally Euclidean (ALE) scalar-flat Kaehler manifolds play a key role as bubbling modes in many differential-geometric problems. However, the study of these spaces has revealed that, while the positive mass theorem holds for asymptotically Euclidean (AE) manifolds, it is wildly false in the more general ALE setting. In this lecture, I will explain a simple formula, discovered in joint work with Hajo Hein, for the mass of any ALE Kaehler manifold. When one specializes to the scalar-flat case, this formula expresses the mass as a topological invariant, depending only on the underlying smooth manifold, the first Chern class of the complex structure, and the Kaehler class of the metric. On the other hand, when the metric is actually AE (asymptotically Euclidean), our formula not only implies the Kaehler case of the positive mass theorem, but moreover yields a Penrose-type inequality for the mass.