TOPICS FOR STUDENT PRESENTATIONS, MATH 668-SPRING 2023

1. Ricci curvature and the ADM mass (NATHAN, TARIQ)

Goal: theorems 4.2 and 4.4 in R. Bartik's *The Mass of An Asymptotically Flat Manifold* (CPAM 1986) and Lemma 2.1 + Theorem 2.3 in M.Herzlich's *Computing Asymptotic Invariants with the Ricci tensor*, etc. (Annales IHP 2016.)—omit the center of mass.

2. Brown-York mass and isoperimetric mass (BEN, STEVE)

Paper: X. Fang, Y. Shi, L-F Tam, *Large sphere and small sphere limits of the Brown-York mass,* ArXiv 0711.2252v1 (2011) Focus on: Theorem 2.1 and Corollary 2.3 of Theorem 2.2 (equality of the isoperimetric mass and the ADM mass in the AF case.)

3. Isoperimetric comparison/ Inverse mean curvature flow (SATHYA, IVY)

Papers: a) H. Bray, F. Morgan, *An isoperimetric comparison theorem for Schwarzschild space and other manifolds,* Proceedings AMS 2001. (Theorem 2.1 , Corollaries 2.3, 2.6)
b) K-K Wong, P. Miao: *A new monotone quantity along the Inverse Mean Curvature Flow in R^n,* Pacific J. Math (2014) (Theorem 1, also Prop. 1, time permitting.)

4. Spacetime Penrose inequality, constraint equations (BRYAN, GEORGE)

Goals: a) Sections 2.1, 2.2 (Derivation of the 3+1 decomposition of the Einstein equations, and of the constraint equations.) R. Bartnik, J. Isenberg: *The Constraint Equations*, ***in*** the Einstein equations and the Large- Scale behavior of gravitational fields (P. Crusciel, H. Friedrich, eds. *b)The spacetime Penrose inequality* (section 7.6 in Dan Lee's book, and Marc Mars' 2009 survey `The Penrose Inequality'. (Classical & Quantum Gravity)—sections 3 and 4. (Explain the conjecture, describe the proof in the rotationally symmetric case.)