

On the positivity of mass for asymptotically hyperbolic Riemannian manifolds

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The positive mass theorem for asymptotically flat Riemannian manifolds is a milestone in mathematical relativity. The original proof of Schoen and Yau is based on a conceptually elegant second variation of area argument. The subsequent spinorial argument of Witten has its own set of merits, but requires spin assumption. Developments in physics over the past few years, specifically the emergence of the AdS/CFT correspondence, a conjectured duality in string theory, has increased interest in the geometrical and physical properties of asymptotically hyperbolic Riemannian manifolds. A very nice formulation and proof of the positivity of mass in this setting was obtained in recent years by X. Wang using a spinor based argument. In an effort to complete this circle of ideas, we discuss an approach to the proof of positivity of mass for asymptotically hyperbolic Riemannian manifolds that does not require spin assumption. Our approach is based on the general methodology of Schoen and Yau, with further hints from the work of Lohkamp. Rather than the area functional, we make use of the “brane action” considered by Witten and Yau in their work on the AdS/CFT correspondence. This is joint work with Lars Andersson and Mingliang Cai.