Contribution ID: **26** Type: **not specified**

The mass of weakly regular asymptotically hyperbolic manifolds

Tuesday, 24 June 2025 16:00 (1 hour)

In mathematical general relativity, the notion of mass has been defined for certain classes of manifolds that are asymptotic to a fixed model background. Typically, the mass is an invariant computed in a chart at infinity, which is related to the scalar curvature and has certain positivity properties. When the model is hyperbolic space, under certain assumptions on the geometry at infinity one can compute the mass using the so-called mass aspect function, a function on the unit sphere extracted from the term describing the leading order deviation of the metric from the hyperbolic background. This definition of mass, due to Xiaodong Wang, is a particular case of the definition by Chruściel and Herzlich which proceeds by taking the limit of certain surface integrals and applies to asymptotically hyperbolic manifolds with less stringent asymptotics. It turns out that these two approaches can be unified in such a way that the resulting definition of mass applies to asymptotically hyperbolic manifolds of very low regularity. In particular, in this setting one can use cut-off functions to define suitable replacements to the potentially ill-defined surface integrals of Chruściel and Herzlich. Moreover, the mass aspect function can be interpreted as a distribution on the unit sphere for metrics having slower fall-off towards hyperbolic metric than those originally considered by Xiaodong Wang. The related notion of mass is well-behaved under changes of coordinates and coincides with the notions of Wang, and Chruściel and Herzlich whenever the later are defined, and we expect that the positivity can be proven. This is joint work with Romain Gicquaud.

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