

Initial data sets that do not satisfy the Regge–Teitelboim conditions

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In General Relativity, an “isolated system at a given instant of time” is modeled as an asymptotically Euclidean initial data set (M, g, K) . Such asymptotically Euclidean initial data sets (M, g, K) are characterized by the existence of asymptotic coordinates in which the Riemannian metric g and second fundamental form K decay to the Euclidean metric δ and to 0 suitably fast, respectively. Using harmonic coordinates Bartnik showed that (under suitable integrability conditions on their matter densities) the (ADM-)energy of an asymptotically Euclidean initial data set are well-defined. To study the (BORT-)center of mass, however, one usually assumes the existence of (strong) Regge-Teitelboim coordinates on the initial data set (M, g, K) in question, i.e. the existence of asymptotically Euclidean coordinates satisfying additional decay assumptions on the odd part of g and the even part of K . We will argue that, under certain circumstances, harmonic coordinates can be used as a tool in checking whether a given asymptotically Euclidean initial data set possesses any such Regge-Teitelboim coordinates. This allows us to easily give examples of asymptotically Euclidean initial data sets which do not possess any Regge-Teitelboim coordinates. This is joint work with Carla Cederbaum and Jan Metzger.