THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

M. E. Taylor Analysis and PDE Seminar

September 13, 2023
3:30 - 4:30 p.m.
Phillips Hall 385

Harmonic coordinates and asymptotic decay conditions

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Abstract. In General Relativity, an "isolated system at a given instant of time" is modeled as an asymptotically Euclidean (AE) initial data set (M, g, K) where (M, g) is a Riemannian manifold, K is a symmetric $(0, 2)$ tensor field (taking the role of and "asymptotically Euclidean" means that there exist asymptotic coordinates in which the Riemannian metric g, the scalar curvature R (or more precisely the mass and momentum densities) and K decay to the Euclidean metric respectively to 0 suitably fast. As shown by Bartnik the existence of such AE coordinates can be characterized by the existence of AE harmonic coordinates and then allows one to define geometric quantities like the mass via flux integrals at infinity. However the AE conditions are not the only decay conditions commonly assumed in Mathematical General Relativity: The so-called Regge-Teitelboim (RT) conditions involve demanding stronger decay on the even (resp. odd) parts of g and R (resp. K). This at first glance seems a very non-geometric condition. In my talk we will see that still, under certain circumstances, the behavior of g, R and K in harmonic coordinates once again determines whether a given AE initial data set admits RT-coordinates or not, allowing us to then give explicit and somewhat natural examples of AE initial data sets which do not admit any RT coordinates. This is joint work with Carla Cederbaum and Jan Metzger.