摘　要

Due to the equivalence principle and the lack of an absolute space, the understanding of the fundamental notion of mass in general relativity has been subtle since Einstein's time. Arnowitt-Deser-Misner gave the well-defined definition for an asymptotically flat isolated system, while Bondi-Trautman gave the definition of mass after gravitation radiation. By 1970's, it was well-recognized that the positivity of these notions, which is intimately related to the stability of the system, lies in the foundation of the theory of general relativity. There was an intense period of the study and the efforts culminated in the proof of the positive mass theorem by Schoen-Yau in 1980's. The subject has since undergone rapid developments. Schoen-Yau's proof led to the deeper understanding of initial data sets and trapped surfaces. Witten's proof led to the notion of mass on asymptotically hyperbolic initial data and the positivity. Many new ideas and techniques from geometric analysis and physics emerge and are applied into the study.