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Abstract

Exploring Warped Compactifications of Extra Dimensions

By

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In 1920s, the concept of extra dimensions was considered for the first time to unify gravity and electromagnetism. Since then there have been many developments to understand the unification of fundamental forces using extra dimensions. In this thesis, we study this idea of extra dimensions in higher dimensional gravity theories such as String Theory or Supergravity to make connections with cosmology. We construct a family of non-singular time-dependent solutions of a six-dimensional gravity with a warped geometry. The warp factor is time-dependent and breaks the translation invariance along one of the extra directions. Our solutions have the desired property of homogeneity and isotropy along the non-compact space. These geometries are supported by matter that does not violate the null energy condition. These 6D solutions do not have a closed trapped surface and hence the Hawking-Penrose singularity theorems do not apply to these solutions. These solutions are constructed from 7D locally flat solution by performing Kaluza-Klein reduction. We also study warped compactifications of string/M theory with the help of effective potentials for the construction of de Sitter vacua. The dynamics of the conformal factor of the internal metric is explored to investigate instabilities. The results works the best mainly in the case of a slowly varying warp factor. We also present interesting ideas to find AdS vacua of N=1 flux compactifications using smooth, compact toric manifolds as internal space.

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