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Critical analysis of modulus stabilization in a higher dimensional F(R) gravity

An exact solution for the bulk five-dimensional geometry is derived for F(R) gravity with nonflat de Sitter 3-branes located at the M4 × Z2 orbifold boundaries. The corresponding form of F(R) that leads to such an exact solution of the bulk metric is derived, which turns out to have all positive integer powers of R. In such a scenario, the stability issue of the modulus (radion field) is analyzed critically for different curvature epochs in both Einstein and Jordan frames. The radion in the effective 4D theory exhibits a phantom epoch, making this model viable for a nonsingular bounce. Simultaneous resolution of the gauge-hierarchy problem is exhibited through the resulting stable value of the radion field in the effective 3 + 1-dimensional theory.

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