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On the Adiabatic Expansion of the Visible Space in a Higher-dimensional Cosmology

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In the context of higher-dimensional cosmologies, with isotropic visible and internal space and multi-perfect fluid matter, we study the conditions under which adiabatic expansion of the visible external space is possible, when a time-dependent internal space is present. The analysis is based on a reinterpretation of the four-dimensional stress-energy tensor in the presence of the extra dimensions. This modifies the usual adiabatic energy conservation laws for the visible universe, leading to a new type of cosmological evolution which includes large-scale entropy production in four dimensions.

KEY WORDS : Entropy production

1. INTRODUCTION

The mathematical background for a non-linear gravitational lagrangian theory, free from metric derivatives of orders higher than the second, was formulated by Lovelock and has been used by several authors [1]. In this case the most general gravitational lagrangian is of the form

$$\mathcal{L} = \sqrt{-g} \sum_{m=0}^{n/2} \lambda_m \mathcal{R}^{(m)}, \tag{1}$$

where λ_m are constants carrying a different physical dimension (length)^{2m} each, yielding a scale of characteristic lengths $l_1, \ldots, l_n$, n denotes the

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