THE EVOLUTION OF HOMOGENEOUS AND ISOTROPIC SUBSPACES IN $f(R)$ GRAVITY

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The compact extra spaces is widely used idea [1, 2, 3, 4]. Any multi-dimensional model has to lead to the effective 4-dim theory. This would imply relations between the observable four-dimensional geometry and a geometry of the higher dimensions.

One of the question remaining not clarified yet is: why specific number of dimensions are compactified and stable while others expand? Which specific property of subspace leads to its quick growth? There are many attempts to clarify the problem, mostly related to introduction of fields other than gravity. It may be a scalar field (most used case) or gauge fields. A static solutions can be obtained using the Casimir effect or form fields. Sometimes one of the subspace is assumed to be Friedmann-Robertson-Walker space by definition. Another possibility was discussed in [5]: it was shown that if the scale factor of our 3D space is much larger than the growing scale factor of the extra dimensions, a contradiction with observations can be avoided.

The origin of our Universe is usually related to its quantum creation from the space-time foam. Here we are interested in the subsequent classical evolution of the metrics rather than a calculation of this probability. Manifolds are nucleated having specific metrics. The set of such metrics is assumed to be very rich. After nucleation, these manifolds evolve classically forming a set of asymptotic manifolds, one of which could be our Universe. In paper [6] we consider models of the $f(R)$ gravity acting in 5 and 6 dimensions. No other fields are attracted to stabilize an extra space. We have found out that a number of asymptotic solutions is quite limited. This conclusion was confirmed both analytically and numerically. There is a set of initial conditions that lead to a common asymptote of classical solutions.

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