

Abstract

Can an Extra Dimension Pull Space-Time? [†]

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[†] Presented at the 1st Electronic Conference on Universe, 22–28 February 2021; Available online: <https://ecu2021.sciforum.net/>.

Abstract: Over the years, efforts to unify gravity with other fundamental forces in nature has been an active field of research. Looking for the common origin of fundamental interactions, one may arrive at Kaluza–Klein type theories. Generalized Kaluza–Klein models offer an attractive possibility of unifying gravity with the other fundamental forces aiming at the extension of space–time from 4D to higher “mathematical” dimensions. In this paper, a generalization of the standard class of exact solutions in Kaluza–Klein (4 + 1) gravity are obtained for a homogeneous cosmological model filled with vacuum energy. In the algebraic and physical sense, these solutions generalize the previously found solutions in the literature. A unified and systematic treatment by solving the field equations in a straight forward manner is more appealing. The deceleration parameter shows that the model exhibits a transition from a decelerated to an accelerated universe. Recent observations have generated strong theoretical and observational evidence that the present expansion of the universe is in an accelerated phase. There is also observational evidence that beyond a certain value of redshift, the universe has been undergoing decelerated expansion. The models which describe transition from a decelerated to an accelerated phase are in the line of observational outcomes and of physical interest. The standard three-space expands indefinitely. Extra dimensions exhibit contraction as well as expansion with suitable values of the parameters. The model rejects the hypothesis of manifesting matter from extra dimensions. However, extra dimensions generate some attractive forces similar to gravity during the early evolution. Consequently, extra dimensions can be responsible for the past deceleration of the universe. The model seems to suggest an alternative mechanism pointing to a smooth transition from a decelerated phase to accelerated phase where the extra dimensions cause the transition.



Citation: Singh, V.; Beesham, A. Can an Extra Dimension Pull Space-Time? *Phys. Sci. Forum* **2021**, *2*, 4. <https://doi.org/10.3390/ECU2021-09518>

Academic Editor: Philippe Jetzer

Published: 19 March 2021

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Keywords: higher dimensional cosmological model

Supplementary Materials: The poster presentation is available online at <https://www.mdpi.com/article/10.3390/ECU2021-09518/s1>.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.