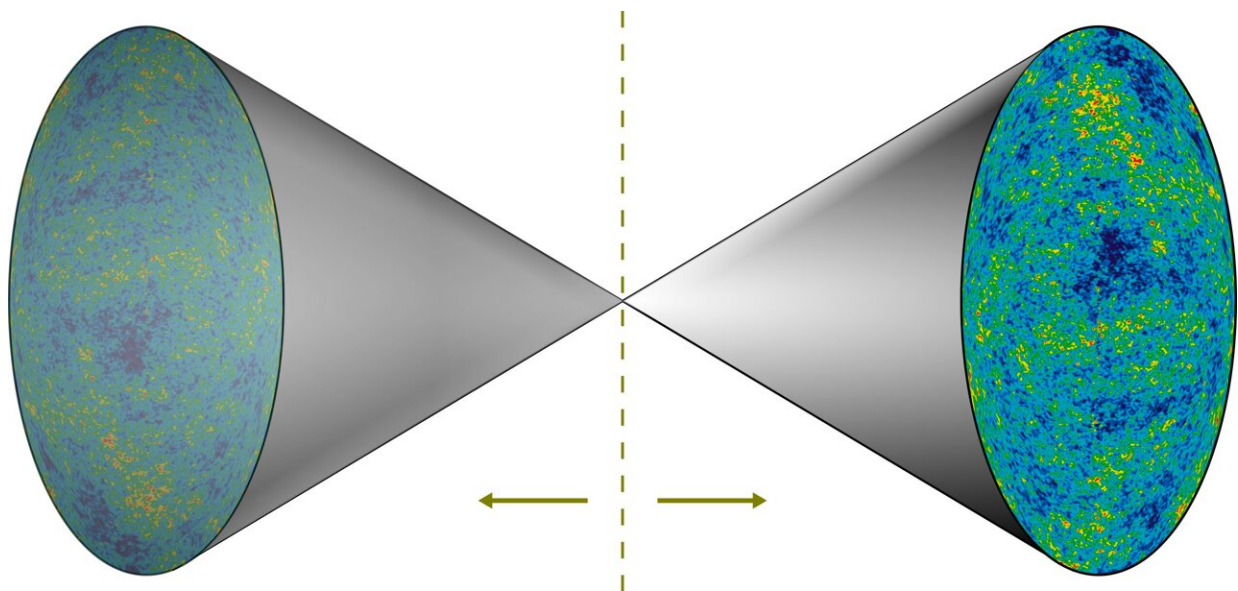


New model suggests partner anti-universe could explain accelerated expansion without the need for dark energy

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A depiction of a universe-antiuniverse pair. Credit: Wikipedia, CC

The accelerated expansion of the present universe, believed to be driven by a mysterious dark energy, is one of the greatest puzzles in our understanding of the cosmos. The standard model of cosmology called Lambda-CDM, explains this expansion as a cosmological constant in Einstein's field equations. However, the cosmological constant itself lacks a complete theoretical understanding, particularly regarding its

very small positive value.

To explain the [accelerated expansion](#), physicists have proposed alternative explanations such as quintessence and modified gravity theories, including scalar-tensor-vector gravity. Additionally, explanations beyond four dimensions, like the braneworld scenarios in the Dvali-Gabadadze-Porrati (DGP) model, modify gravity at large distances due to the effect of a higher-dimensional bulk on our four-dimensional brane, and variable brane tension.

My new model

In my work, I propose another model to explain the present accelerated expansion of the universe. Unlike existing models, this does not require any form of dark energy or modified gravity approaches. However, there is a price to pay: we need a partner anti-universe whose time flow is oppositely related to our universe.

There are strong arguments supporting this concept. From a quantum theory perspective, it is natural for the universe to be created in pairs. Recently, [Boyle et al](#) proposed that the universe does not spontaneously violate CPT (Charge, Parity, and Time reversal symmetry), but rather, the universe after the Big Bang is the CPT image of the universe before it, pointing towards a partner anti-universe.

Recent results

In a recent paper [published](#) in *Gravitation and Cosmology*, I used key concepts from quantum theory, such as relative entropy, and from [general relativity](#), such as the null energy condition, which corresponds to the positive energy condition. My findings suggest that the universe naturally expands in an accelerated manner.

Relative entropy, which requires two states, in this case, corresponds to the universe and its partner anti-universe. Accelerated expansion seems inevitable in a universe created in pairs that respect the null energy condition. This result is quite surprising and readers familiar with Hawking's area theorem may notice some similarities. The area theorem also deals with causal horizons and requires the null energy condition to hold.

In our model, the causal horizon corresponds to the Big Bang. The results apply equally to the partner anti-universe.

To sum up, the accelerated [expansion of the universe](#) is a challenging subject that continues to drive scientific efforts. Building on existing theories, my model offers an explanation using standard concepts from [quantum theory](#) and general relativity, without the need for elusive dark [energy](#).

The results indicate that accelerated expansion is natural for a universe created in pairs. Moreover, studying causal horizons can deepen our understanding of the universe. The beauty of this idea lies in its simplicity and naturalness, setting it apart from existing explanations.

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More information: Naman Kumar, On the Accelerated Expansion of the Universe, *Gravitation and Cosmology* (2024). [DOI: 10.1134/S0202289324010080](#)

Naman Kumar is currently a Ph.D. student at the Indian Institute of Technology, Gandhinagar, India. Kumar's areas of interest include general relativity, cosmology, braneworld, and spacetime thermodynamics.

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