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Impacts of Spatial Curvature on Exponential Quintessence Cosmology

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A quintessence cosmological model with an exponential potential $V(\phi) = V_0 e^{-\lambda\phi}$ is explored to explain the accelerated expansion of the universe. This model introduces a scalar field ϕ, whose dynamics are governed by the parameter λ, which is linked to the evolution rate of dark energy. One of the key aspects of this study is the inclusion of spatial curvature, which has significant implications for cosmological predictions. In particular, the presence of curvature allows for an extended range of acceptable values for λ, a parameter constrained by cosmological observations. While in a flat universe λ is limited to values below $\sqrt{2}$, the inclusion of curvature relaxes this bound, allowing for higher values such as $\lambda \approx 2.236$, opening new possibilities for the model's compatibility with observational data.

Another interesting result is the emergence of a new attractor point in the dynamical systems analysis when curvature is considered. This point drives the universe's trajectories toward an accelerated expansion phase, modifying the long-term behavior of the universe compared to the flat model. Furthermore, the analysis shows that curvature affects the evolution of the scalar field's equation of state parameter, w_ϕ, which tends to more negative values in the presence of curvature, a feature that is observationally favorable.
These results provide deeper insights into how spatial curvature influences the dynamics of dark energy, suggesting that models with curvature could offer a better fit to recent observational data.

This presentation is based on the paper entitled "Exponential Quintessence:
curved, steep and stringy?"

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