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Positive curvature from scalar field tunneling in the landscape

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We present a model of vacuum tunneling through a classically forbidden region where a scalar field changes its value simultaneously over the entire volume of a (meta)stable ancestor vacuum with spherical curvature. The ancestor, analyzed by Graham et al. as the "simple harmonic universe," consists of positive curvature, negative vacuum energy, and matter with positive sound speed squared and $-1 < p/\rho < -1/3$, and can be stable at the level of linearized perturbations. The tunneling leaves the geometry unchanged but rearranges the energetic contributions of the matter sources, leading to an inflating solution with residual positive curvature. We show that there exists a parametric regime where this solution is self-consistent and dominates the overall tunneling rate. We conclude that an experimental detection of positive curvature, while not necessarily likely, therefore does not rule out the possibility that our present observer patch originated from semiclassical vacuum tunneling in a string or field theoretic landscape.

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