Active Screen Gravity: Running Planck Mass as the Origin of the Inflationary Attractor

Abstract

We present a scalar–tensor cosmological model in which inflation is driven by the running of the effective Planck mass rather than by tuning of the inflaton potential.
A localized deformation of the gravitational coupling generates an ultra-flat effective potential via dynamical slope cancellation.
The spectral index is controlled by curvature of the Planck mass while the tensor amplitude depends on its slope, producing a correlated trajectory in the (n_s, r) plane.
The framework preserves single-field consistency relations and predicts r ∼ 10^-4 without fine tuning.

1. Introduction

Standard inflationary models typically assume a flat potential. Active Screen Gravity instead attributes flatness to geometry: a varying gravitational coupling modifies the Einstein-frame potential.

2. Jordan Frame Action

$$S = \int d^4x \sqrt{-g}\, [\, F(\chi)\, R - 1/2\, (\partial\chi)^2 - V(\chi)\,]$$

A conformal transformation to the Einstein frame produces an effective potential:

$$U(\chi) = V(\chi)/F(\chi)^2$$

3. Renormalization Group Origin

$$dG/d\ln\mu = a\, G^2$$

$$G(\mu)=G0/(1 - aG0\, \ln(\mu/\mu0))$$

Threshold decoupling yields a localized deformation approximated by:

$$F(\chi)=1 + \beta\, exp[-(\chi-\chi0)^2/\Delta^2]$$

4. Slow-roll Dynamics

$$\varepsilon = 1/2\, (U'/U)^2$$

$$\eta = U''/U$$

$$n_s = 1 - 6\varepsilon + 2\eta$$

$$r = 16\varepsilon$$

Cancellation between V'/V and F'/F produces an attractor solution.

5. Tensor Sector

$$n_T = -2\varepsilon$$

$$r = -8\, n_T$$

Consistency relation preserved; tensors propagate at light speed.

6. Observational Predictions

The model predicts n_s ≈ 0.965–0.97 and r ≈ 10^-4 forming a correlated trajectory distinct from α-attractors.

Figures

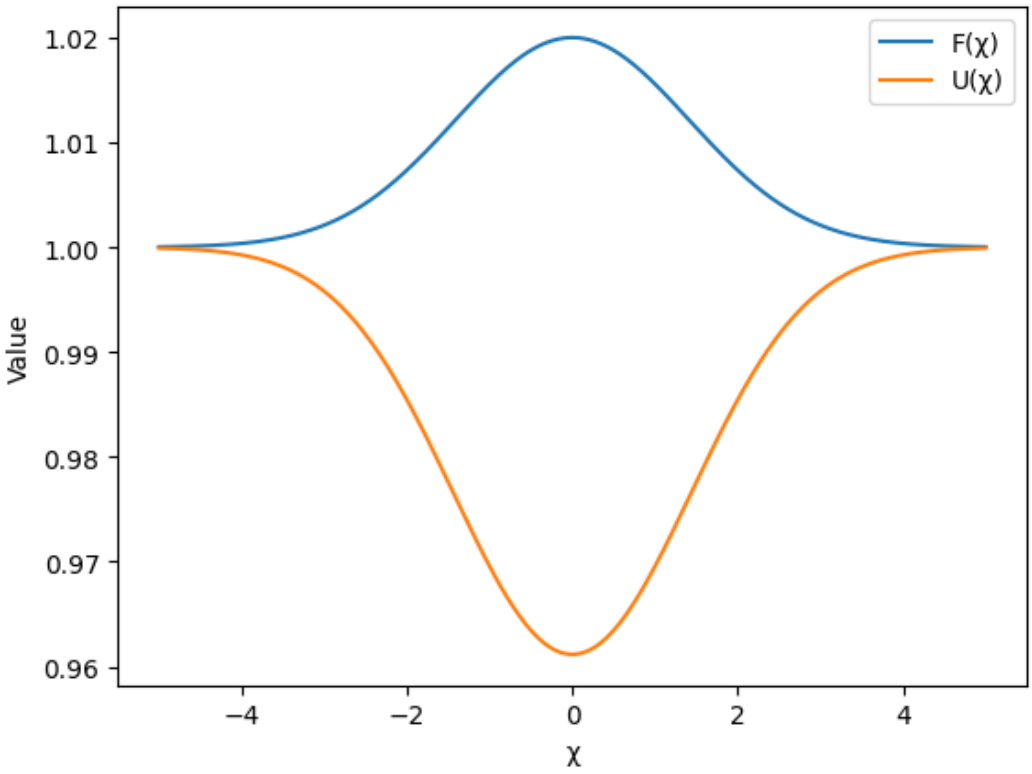

Figure 1: Planck mass deformation and effective potential

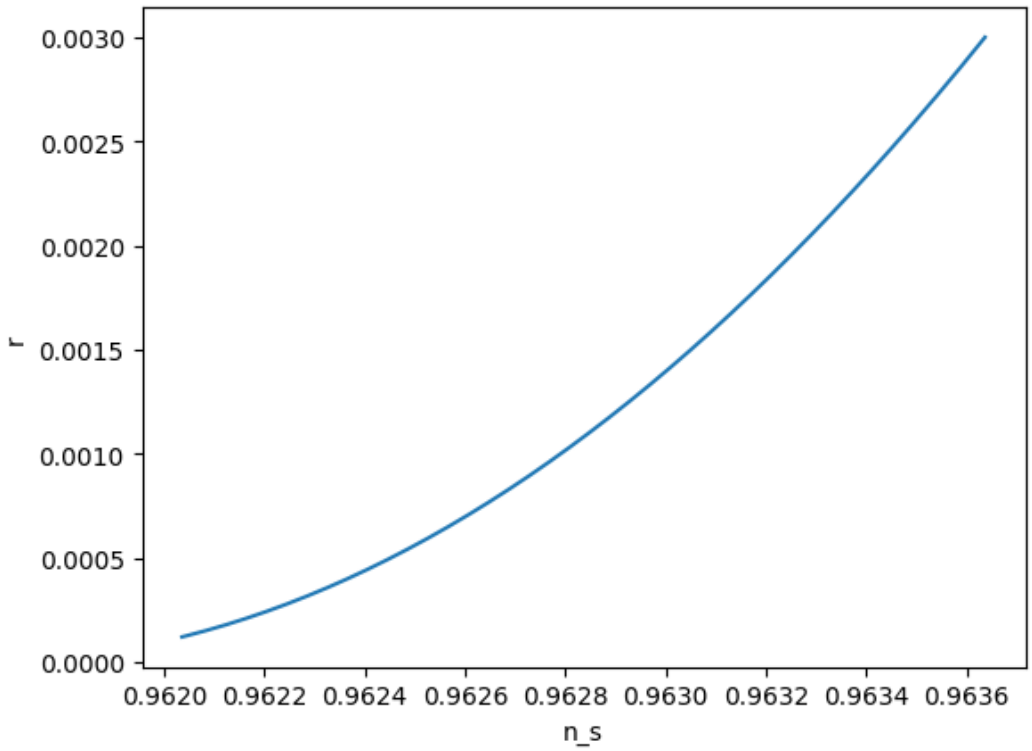

Figure 2: Predicted trajectory in the (n_s, r) plane

Conclusion

Inflation arises from geometry rather than potential shape, providing a new mechanism testable by future CMB experiments.