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

Abstract

We develop a scalar–tensor inflationary model in which cosmological observables are governed by a running effective Planck mass.
A localized deformation of the gravitational coupling produces an ultra-flat Einstein-frame potential through geometric slope cancellation.
The model preserves single-field consistency relations and predicts $r \sim 10^{-4}$.

1. Jordan Frame Action

We start from a scalar–tensor action:

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

After conformal transformation $g_{E\mu\nu} = F(\chi) \, g_{J\mu\nu}$ we obtain Einstein frame dynamics.

2. Effective Potential

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

Inflation occurs when derivatives of U are small due to cancellation between potential slope and Planck-mass gradient.

3. RG Origin

Running Newton coupling:

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

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

Threshold matching produces Gaussian deformation:

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

4. Slow-roll parameters

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

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

$$U'/U = V'/V - 2F'/F$$

5. Observables

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

$$r = 16\varepsilon$$

6. Tensor sector

$$P\_T = 2H^2/(\pi^2 M\_*^2)$$

$$n\_T = -2\varepsilon$$

$$r = -8\, n\_T$$

7. Physical interpretation

Inflation occurs as the scalar crosses a transition in gravitational strength.
Tilt measures curvature of the running coupling while tensors measure its slope.

References

Starobinsky A.A. (1980) Phys. Lett. B91

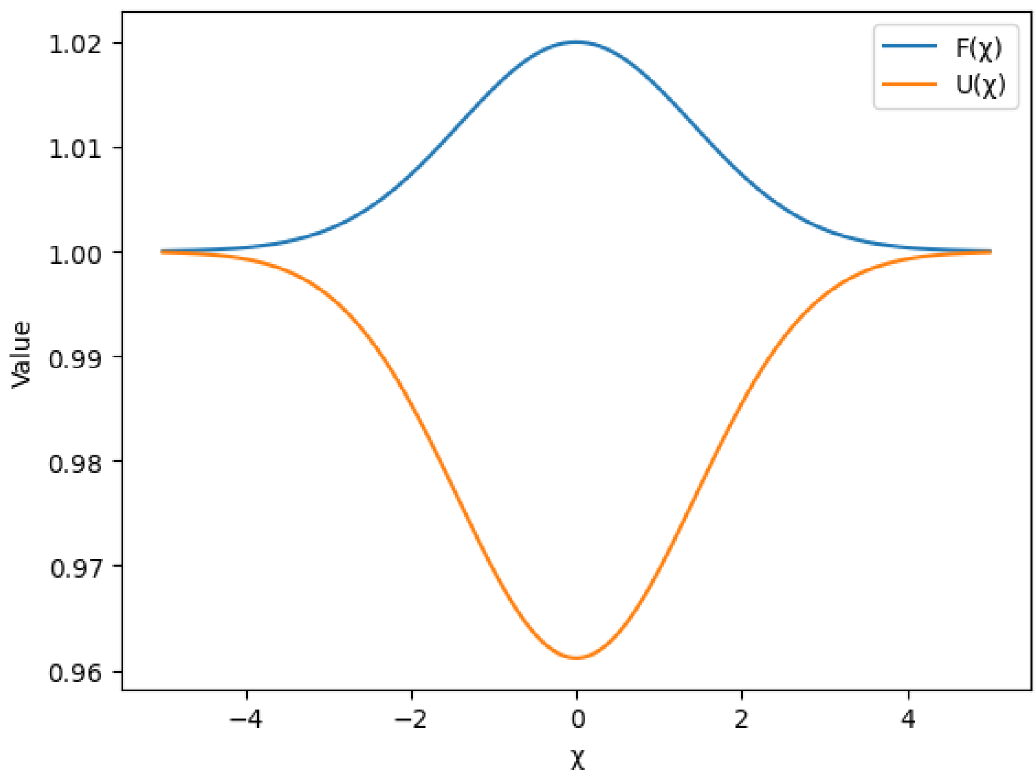
Mukhanov, Feldman & Brandenberger (1992) Physics Reports

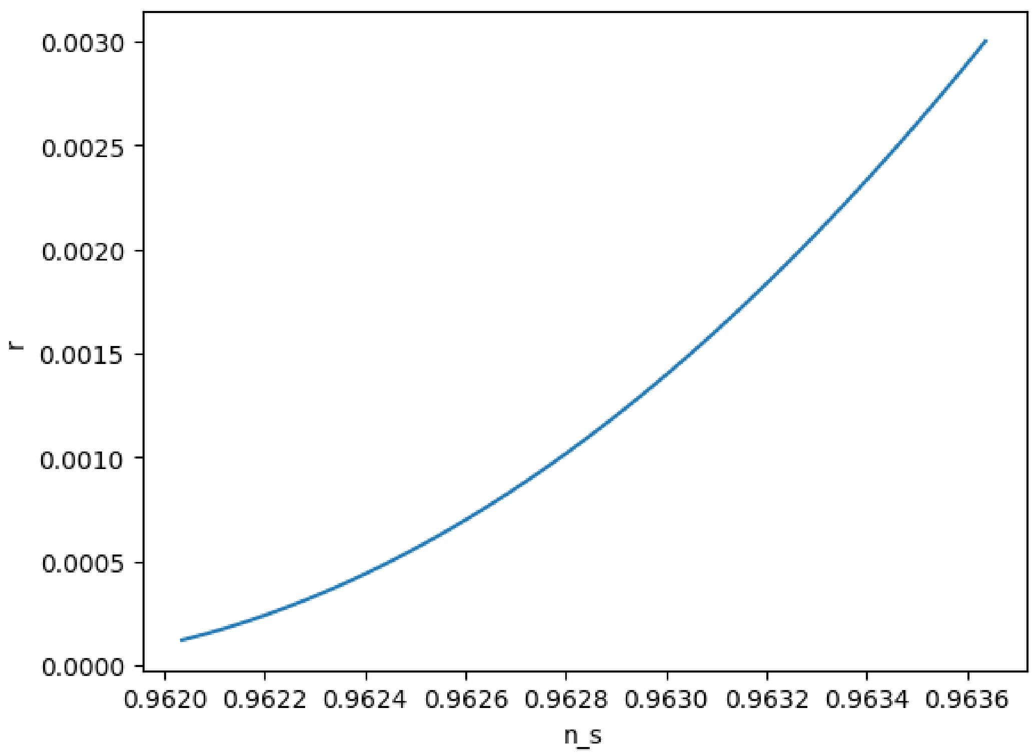
Planck Collaboration (2018) Cosmological Parameters

Kallosh & Linde alpha-attractors

Baumann TASI Lectures on Inflation

Figures

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