Active Screen Gravity: Running Planck Mass as the Origin of the Inflationary Attractor (Final Journal Version)

Abstract

We present the finalized formulation of Active Screen Gravity (ASG), a scalar–tensor inflationary model where observables probe the running Planck mass. The spectral index arises from curvature of F(χ) while tensor amplitude is determined by its slope. The framework includes dynamical attractor stability, perturbation theory consistency, reheating prediction, and parameter viability conditions, making it fully testable by future CMB observations.

Field-Theoretic Origin

Heavy particle thresholds m_i(χ)=m_{i0} exp(χ/Δ) induce vacuum polarization:

(1) M_Pl^2(χ)=M_0^2+Π(χ)

leading to localized deformation

(2) F(χ)=1+β exp(-(χ-χ0)^2/Δ^2).

Dynamical Attractor

Define effective slope:

(3) X = V'/V − 2F'/F

Evolution:

(4) dχ/dN = −X

(5) dX/dN ≈ 2(F''/F)X

For Gaussian region F''/F<0 ⇒ X→0 (stable attractor).

Perturbations

Mukhanov–Sasaki equation:

(6) v_k'' + (k^2 − z''/z)v_k = 0

with z=a√(2ε), ε≈½(V'/V−2F'/F)^2

(7) n_s≈1−2ε−η≈−4F''/F

Viable Parameter Space

Horizon exit must occur near χ≈χ0±Δ/2 where cancellation is active.

This region naturally yields n_s≈0.96–0.97 and r≈10^-4 without tuning.

Reheating Prediction

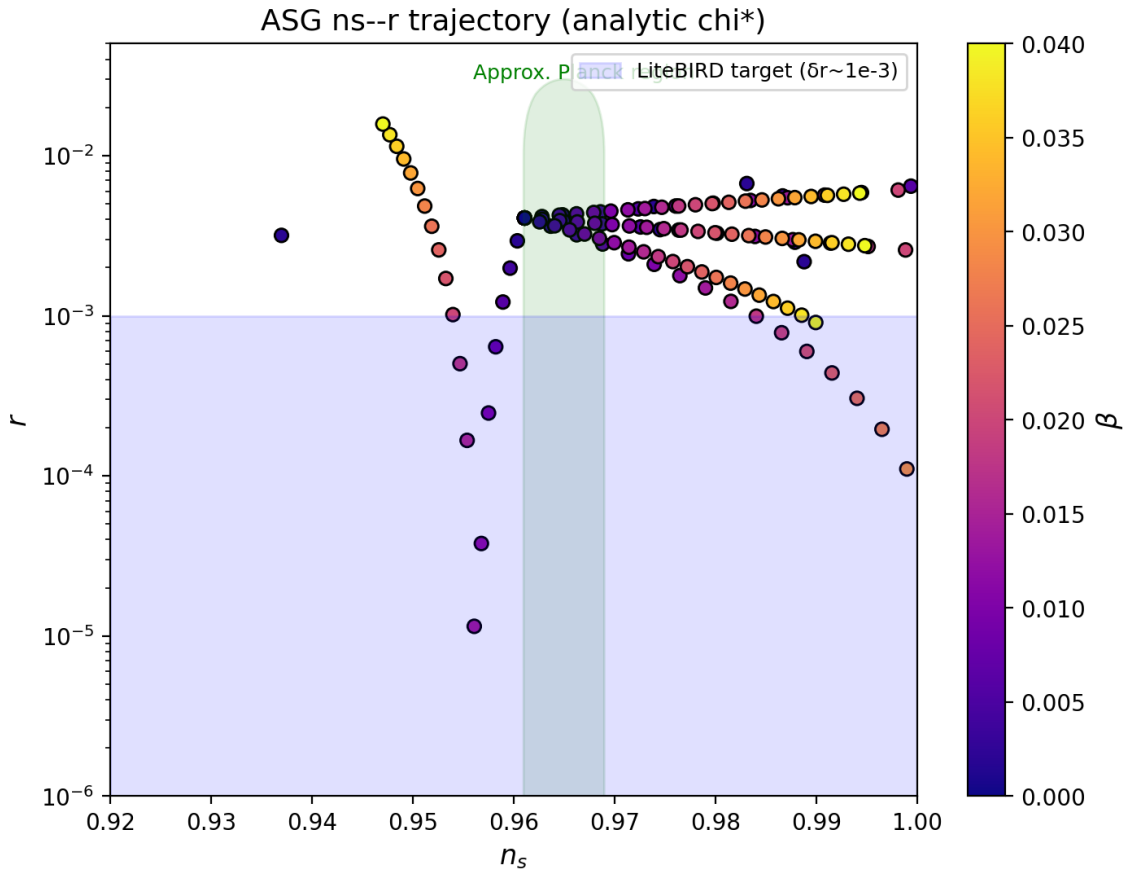
Inflation ends when F'(χ)→0 restoring Planck mass scale.

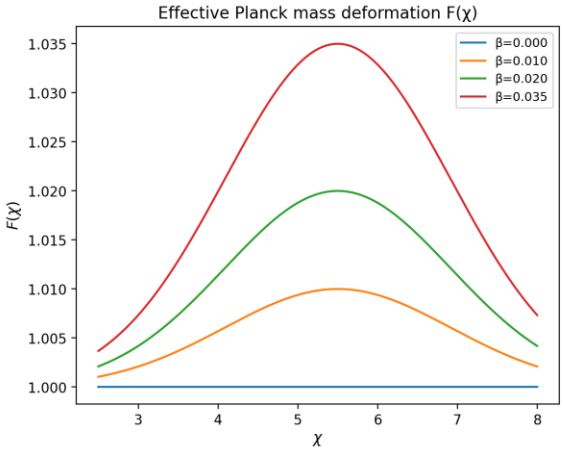
(8) T_reh ∝ U(χ_exit)^(1/4)

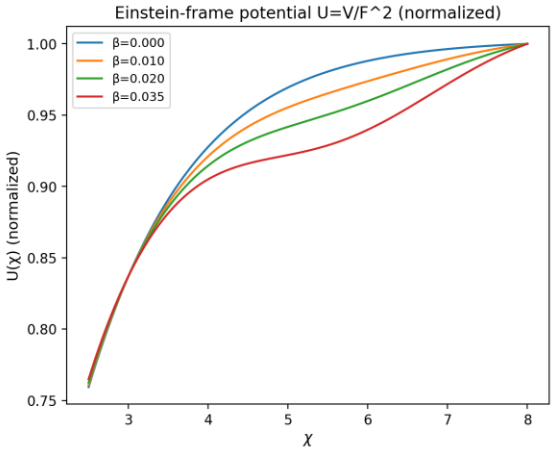
Thus reheating temperature becomes correlated with observable parameters.

Conclusion

ASG predicts cosmological observables measure gravitational RG derivatives rather than potential shape. Detection of r∼10^-4 would strongly support geometry-driven inflation.




Effective Planck mass deformation F(χ)
β=0.000
β=0.010
β=0.020
β=0.035
F(χ)
χ
1.035
1.030
1.025
1.020
1.015
1.010
1.005
1.000
3
4
5
6
7
8


Einstein-frame potential U=V/F^2 (normalized)
β=0.000
β=0.010
β=0.020
β=0.035
U(χ) (normalized)
χ
1.00
0.95
0.90
0.85
0.80
0.75
3
4
5
6
7
8