

# Scale-free inflation

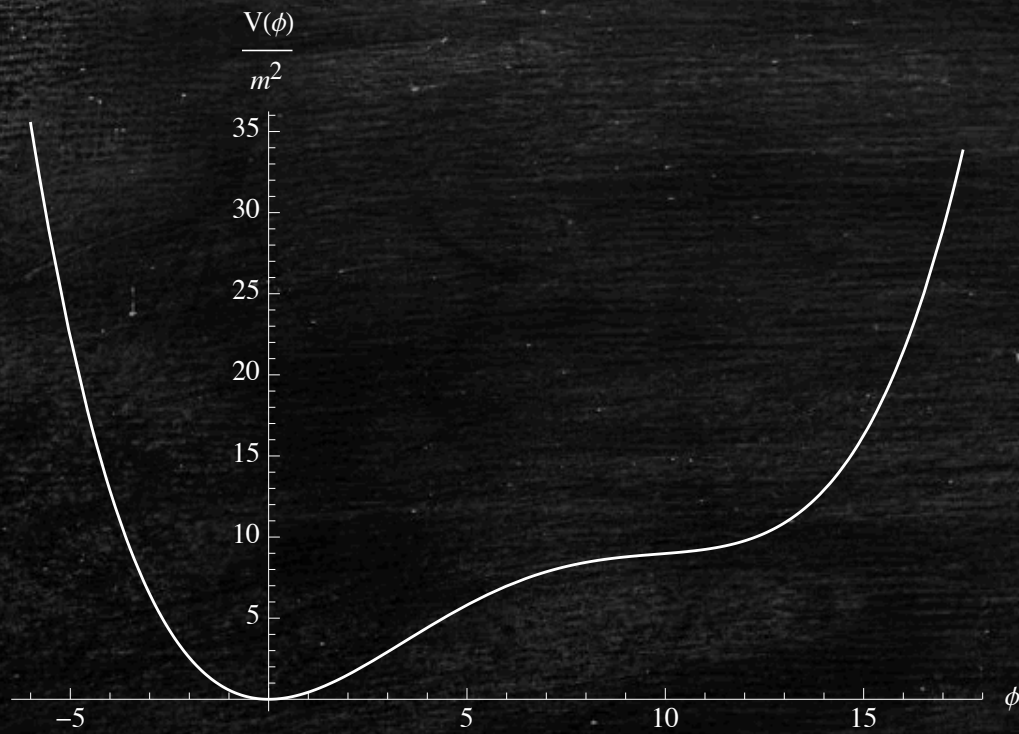
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arXiv:1309.4480

# Parameter unpredictability

$$V(\phi) = m^2 \phi^2 / 2 [1 - \sqrt{2} (\lambda / m) \sin(\vartheta) \phi + 1/2 (\lambda / m)^2 \phi^2]$$



Planck2013 fit:

$$m = (1-2) \times 10^{13} \text{ GeV}$$

$$\lambda = (3-7) \times 10^{-7}$$

$$\vartheta = 23\pi/60$$

Destri, De Vega, Sanchez 2008  
Nakayama, Takahashi, Yanagida 2013  
Ferrara, Kallosh, Linde, Porrati 2013

## Restoring predictability

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$$\varepsilon(N) = 3/2(w+1), \quad w = p/q$$

**NOTE:**  $\varepsilon$  can take many forms and the predictions can vary arbitrarily!

-> additional assumption: SCALE-FREE PHYSICS

$$\varepsilon(N) = 1/(N+1)^\alpha, \quad \alpha > 0$$

## Restoring predictability

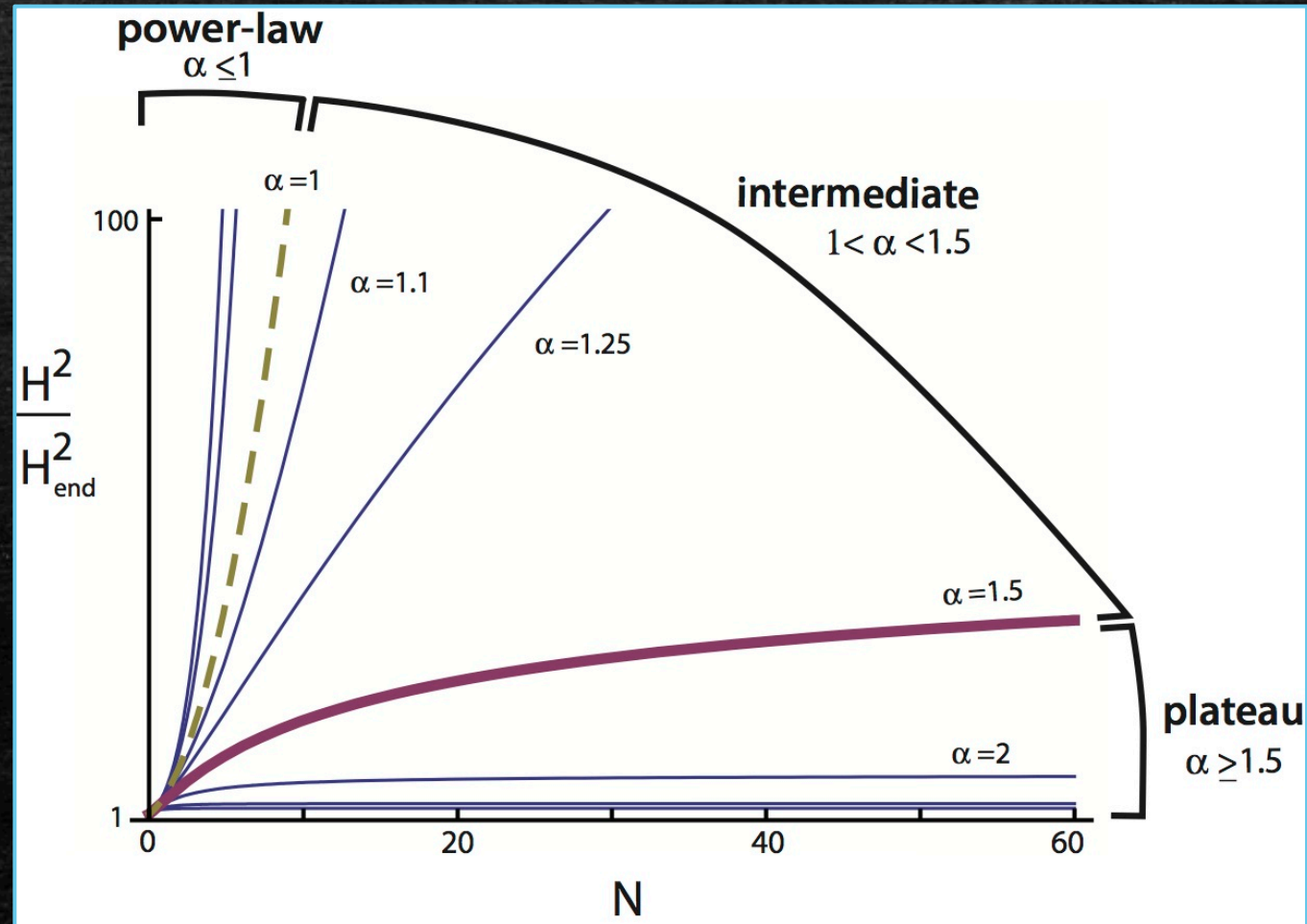
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$$H^2/H_{\text{end}}^2 = \begin{cases} (N+1)^2, & \alpha = 1 \\ \exp[2(1-(N+1)^{1-\alpha})/(\alpha-1)], & \alpha \neq 1 \end{cases}$$

$$n_s - 1 = -2/(N+1)^\alpha - \alpha/(N+1)$$

$$r = 16\varepsilon = 16/(N+1)^\alpha$$

# THREE DISTINCT CLASSES OF INFLATIONARY MODELS!



1) extra parameters, 2) initial conditions problem, 3) unlikeliness problem

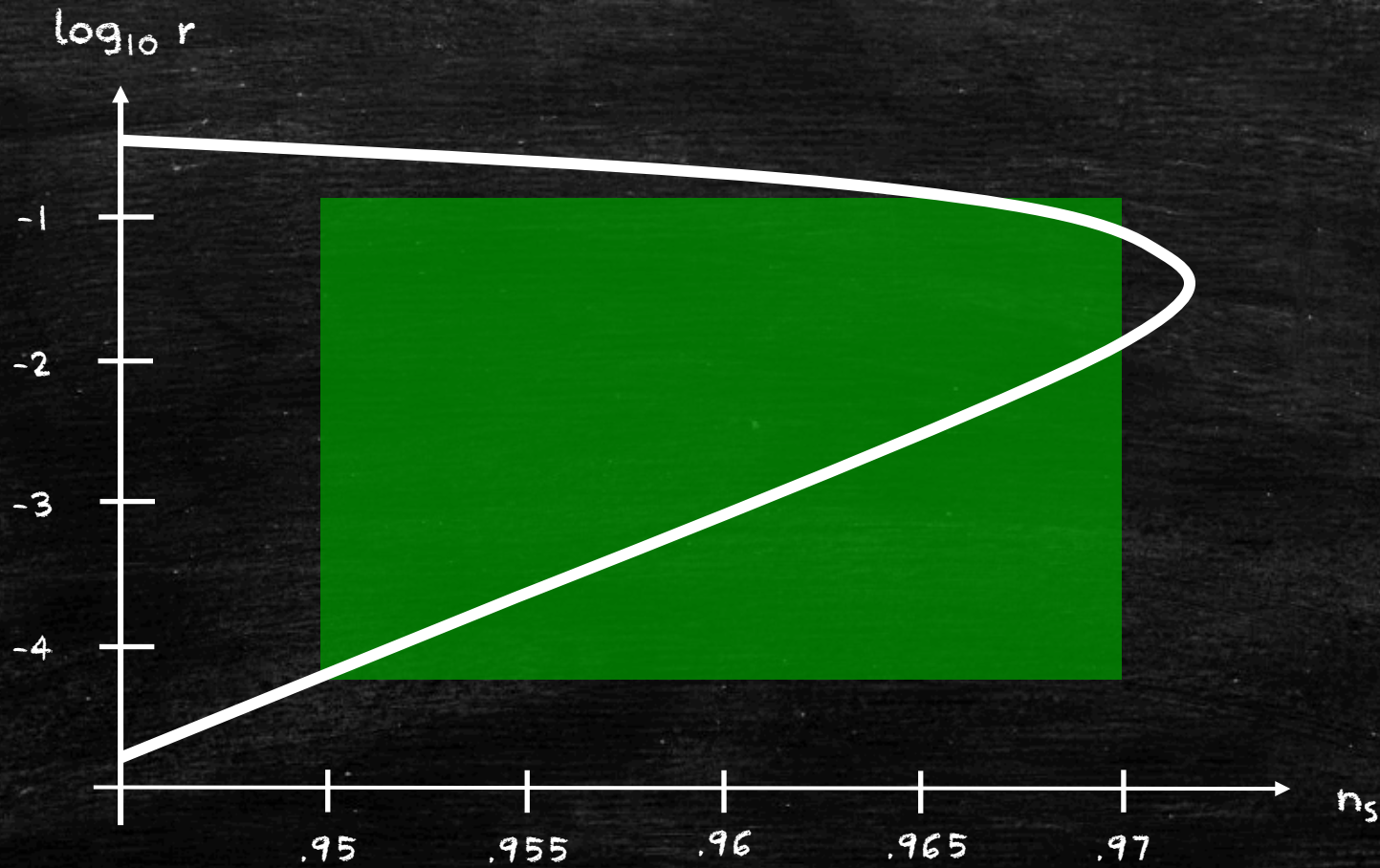
## Testing for scale-freeness

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- 1) measure  $r$
- 2) determine  $\alpha_r$
- 3) check if  $n_s - 1(\alpha_r)$  fits data

# Testing for scale-freeness

scale-free  $n_s - r$  combinations



# Testing for scale-freeness

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Possible future scenarios:

1)  $r \geq 10^{-4}$ : scale-free inflation if  $n_s - 1(\alpha_r)$  fits data

NOTE:  $r < .1$  fits only scale-free models that suffer from the unlikeliness, extra parameters, and initial conditions problems

2)  $r < 10^{-4}$ : scale-free cyclic