Reheating After Swampland Conjecture

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BASU and IPM

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Outline

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Old inflation

First order phase transition

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- Tunneling effect

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- Tunneling effect
- Graceful exit problem

First order phase transition

new inflation

First order phase transition

- Slow-roll

new inflation

First order phase transition

- Slow-roll
- Thermalization

Swampland

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- Field excursion

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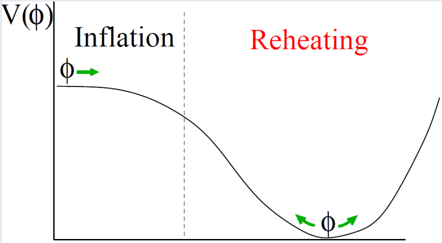
- Field excursion
- Distance conjecture

Old Inflation

Condition

The idea of old inflation was introduced in term of scalar field theory which experiences the first order phase transition.

Evolution of the Inflaton



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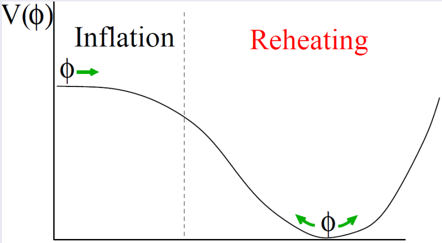

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We know from G.R in order to realize inflation, it requires an equation of state $P < -\rho/3$, thus a substance with negative pressure that scalar fields can provide such an equation of state.

$$\rho(\phi) = \frac{1}{2}\dot{\phi}^2 + V(\phi) \qquad P(\phi) = \frac{1}{2}\dot{\phi}^2 - V(\phi) \tag{1}$$

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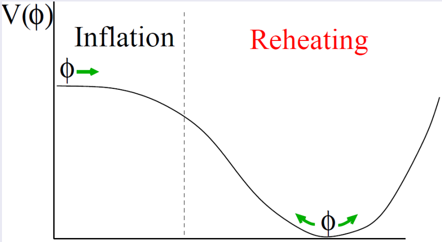

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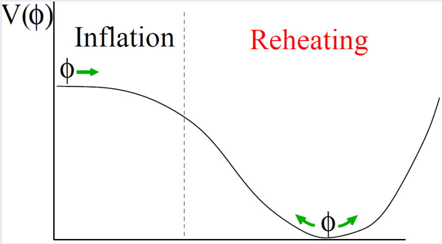
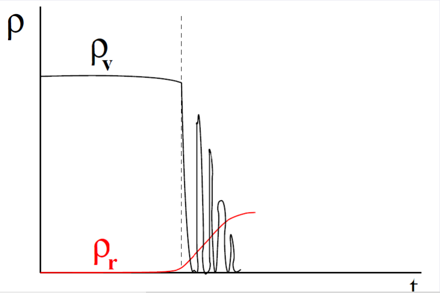


Evolution of Energy Density



Evolution of the Scalar Field

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- Energy Density Conservation

$$\dot{\rho} + 3H(\rho + P) = 0 \, , \tag{2}$$

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- Equations Describing the Evolution of Scalar Field

$$\ddot{\phi} + 3H\dot{\phi} + \frac{dV}{d\phi} = 0 \,, \; \epsilon = \frac{1}{2}M_p^2\left(\frac{V'}{V}\right)^2,$$

where H is Hubble parameter

Reheating

Interacting Potential

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Interacting Potential

- Non-thermal phase

$$V(\phi,\chi) = \frac{\lambda}{4}(\phi^2 - \phi_0^2)^2 + \frac{1}{2}g^2\phi^2\chi^2 \tag{3}$$

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$$V(\phi,\chi) = \frac{1}{2}m_\phi^2\phi^2 + \frac{1}{2}m_\chi^2\chi^2 + \sigma\phi\chi^2 + h^2\phi^2\chi^2 + k\chi^4 \tag{4}$$

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$$\frac{|\nabla V(\phi)|}{V} > \frac{c_2}{M_p} \quad or \quad \frac{\min(\nabla_i \nabla_j V(\phi))}{V} \leq -\frac{c_3}{M_p^2}, \tag{6}$$

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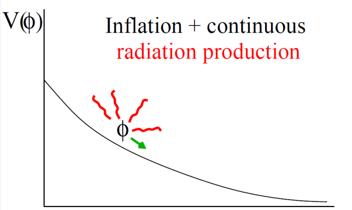

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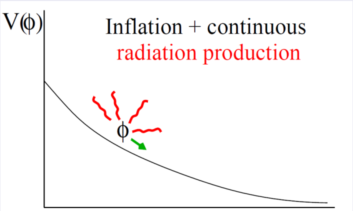

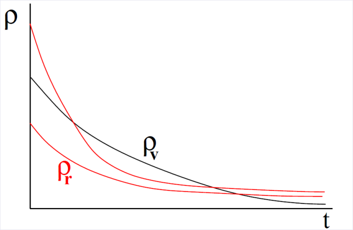

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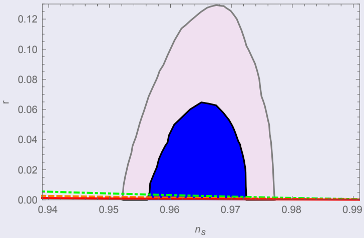

- 1σ and 2σ confidence regions which borrowed from Planck [**?**], $r - n_s$ trajectories of the present model in high dissipative regime. The solid red, dashed orange and dot-ashed green lines correspond to Γ_0 values: 3.14×10^{-3}, 6.28×10^{-3} and 1.25×10^{-2}.

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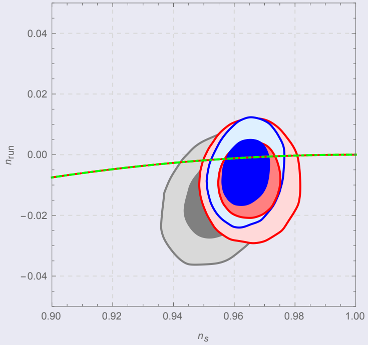

- The area corresponds to Planck data and $n_s - n_{run}$ trajectories relate to our model.The solid red, dashed orange and dot-ashed green lines correspond to Γ_0 values: 3.14×10^{-3}, 6.28×10^{-3} and 1.25×10^{-2}.

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Thanks for your attention