Measuring the Effect of LQC in the CMB Data (tachyon warm model)

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Outline

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Cold Inflation

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- Standard Model of inflation

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- Reheating

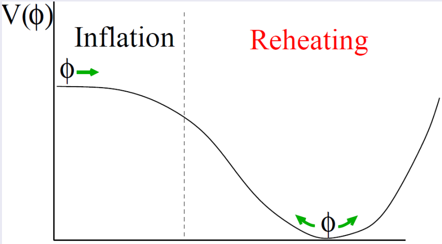
Standard inflation

condition

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.

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

Evolution of the inflaton



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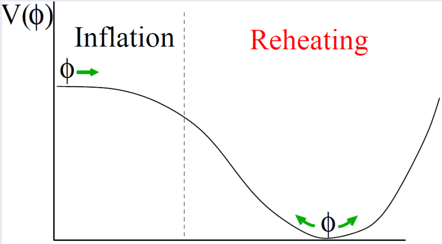
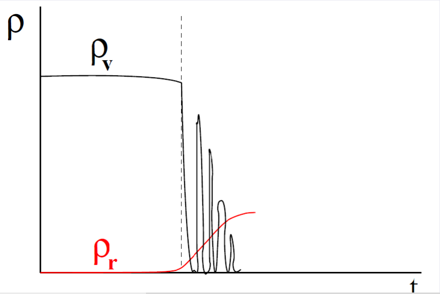


Evolution of energy density



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- The equations describing the evolution scalar field

$$\ddot{\phi} + 3H\dot{\phi} + \frac{dV}{d\phi} = 0 \ , \ H^2 = \frac{8\pi G}{3}\rho$$

where H is Hubble parameter

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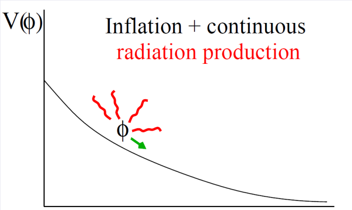

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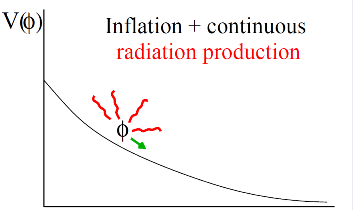

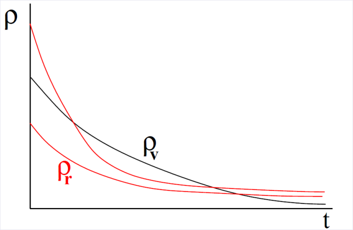

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- In warm inflation model we have$T > H$.

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- We can present these parameters for our model

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- Pressure and energy density of tachyonic fluid in FRW universe we have
$$\rho_\phi = \frac{V(\phi)}{\sqrt{1 - \dot\phi^2}} \qquad P_\phi = -V(\phi)\sqrt{1 - \dot\phi^2} \tag{11}$$

- slow-roll limit

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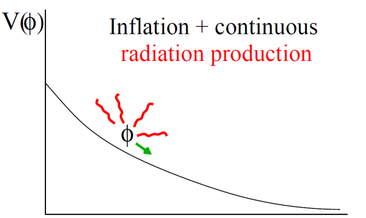
$$\dot{\phi}^2 \ll 1 \quad \Rightarrow P = -\rho$$

- Notice, that tachyon potentials have the following two properties: the maximum of the potential occurs when $\phi \to 0$ while the corresponding minimum takes place when $\phi \to \infty$.



LQG in FRW universe

LQC

LQC is LQG limit in FRW universe which modified Friedmann equation in a sense that the singularity is removed.

- Modification of first Friedmann equation

$$H^2 = \frac{8\pi G}{3}\rho(1 - \frac{\rho}{\rho_c}) \tag{12}$$

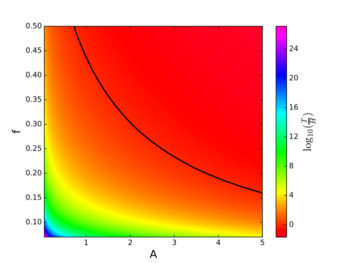
  where ρ_c is constant
- Warm LQC

$$\rho = \rho_\phi + \rho_\gamma \qquad P = P_\phi + P_\gamma \tag{13}$$

Results

Summary of results

we estimate analytically the slow-roll parameters and we compare our predictions with those of other inflationary models as well as we test the performance of warm LQC inflation against the observational data.



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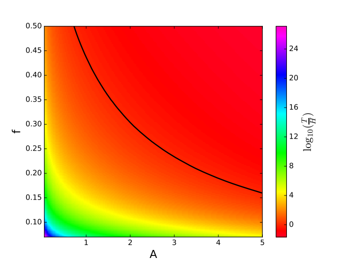

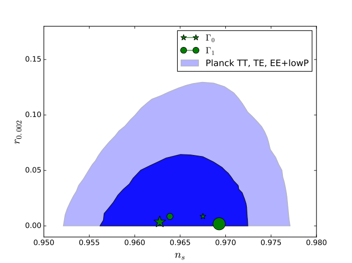

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Thanks for your attention