

PBH - Eq,7, 8

T.G. Kim

1 Eq.7, 8

1) ϕ

Note : $\lambda' = \frac{d\lambda}{d\phi}$ and also for ξ' .

– **Ver.1**

$$\epsilon(\phi) = \frac{8M_p^2}{\phi^2} \frac{\left(1 + \frac{\lambda'}{4\lambda} \left(1 + \xi \left(\frac{\phi}{M_p}\right)^2\right) \phi - \frac{\xi'}{2} \left(\frac{\phi}{M_p}\right)^2 \phi\right)}{1 + (1 + 6\xi)\xi \left(\frac{\phi}{M_p}\right)^2} \quad (1)$$

– **Ver.2**

$$\text{Condition :} \quad 1 + \xi \left(\frac{\phi}{M_p}\right)^2 \equiv X, \quad 1 + (1 + 6\xi)\xi \left(\frac{\phi}{M_p}\right)^2 \equiv Y, \quad \frac{d\phi}{d\phi} = \frac{\sqrt{Y}}{X} \quad (2)$$

$$\epsilon(\phi) = \frac{8M_p^2}{\phi^2} \left(\frac{1}{\sqrt{Y}} + \frac{\lambda'}{4\lambda} \frac{X}{\sqrt{Y}} \phi - \frac{\xi'}{2\xi} \frac{X-1}{\sqrt{Y}} \phi \right)^2 \quad (3)$$

$$\begin{aligned} \eta(\phi) = & \frac{8M_p^2}{\phi^2} \left(\frac{X}{\sqrt{Y}} \right)^2 \left[\frac{1}{X} \left(\frac{3}{2XY} - \left(1 - \frac{1}{Y}\right) \left(1 - \frac{2}{X}\right) \right) \right. \\ & + \frac{\lambda'}{\lambda} \left\{ \frac{1}{8} \left(1 + \frac{6}{X}\right) \left(1 + \frac{1}{Y}\right) - \frac{3}{4XY} + \frac{\xi'}{2\xi} \left(\frac{X+1}{8Y} + \frac{3}{4X} - 1 \right) \phi \right\} \phi \\ & - \frac{\xi'}{4\xi} \left(1 + \frac{9-10Y}{X} - \frac{8}{X^2}\right) \phi - \left(\frac{\xi'}{2\sqrt{2}\xi} \right)^2 \left(1 - \frac{1}{X}\right) \left\{ \left(\frac{X}{Y} - 6 \right) \left(1 + \frac{1}{X}\right) + \frac{5}{X} \left(2 + \frac{1}{Y}\right) \right\} \\ & \left. + \frac{\lambda''}{8\lambda} \phi^2 - \frac{\xi''}{4\xi} \left(1 - \frac{1}{Y}\right) \phi^2 \right] \quad (4) \end{aligned}$$

2) φ

Caution : $\lambda' = \frac{d\lambda}{d\varphi}$ and also for ξ' .

$$\epsilon(\phi) = \frac{8M_p^2}{\phi^2} \left[\frac{1}{\sqrt{Y}} + \frac{\lambda'}{4\lambda} \phi - \left(1 - \frac{1}{X}\right) \frac{\xi'}{2\xi} \phi \right]^2 \quad (5)$$

$$\begin{aligned} \eta(\phi) = \frac{8M_p^2}{\phi^2} & \left[\frac{\lambda''}{8\lambda} \phi^2 + \frac{\lambda'}{\lambda} \left(\frac{1}{\sqrt{Y}} - \left(1 - \frac{1}{X}\right) \frac{\xi'}{2\xi} \phi \right) \phi + \frac{\xi'}{4\xi} \frac{1}{\sqrt{Y}} \left(-12 + \frac{10}{X} + \frac{X+1}{Y} \right) \phi \right. \\ & \left. + 3 \left(\frac{\xi'}{2\xi} \right)^2 \left(1 - \frac{1}{X}\right)^2 \phi^2 - \left(1 - \frac{1}{X}\right) \frac{\xi''}{4\xi} \phi^2 + \left(\frac{1}{Y} (2 - X) + \frac{X}{2} \right) \right] \quad (6) \end{aligned}$$