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Due to an error in our numerical code, the results about the evolutions of the scalar field \( \Phi \), the Hubble rate \( H \) and scale factor \( a \) in the deformed model presented in the paper are incorrect. The corrected results are depicted in Figs. 1–3 respectively. As results, one can find that when neglecting reheating the universe will experience multi cycles of expansions and contractions as showed by the damped oscillating behavior of \( H \) in Fig. 2. Each cycle contains non-singular bounces between expanding and contracting phases, as showed in Fig. 3. Gradually the universe approaches to a static universe. This is similar to inflation. Without reheating the inflaton field will oscillates with damped amplitude around the minimum of its potential and the universe enters into the static phase in the future if the cosmological constant vanishes. However, in a real universe reheating is necessary and it will interrupt the oscillations and lead the universe to the radiation dominated epoch. In the model considered in this paper, the exit from oscillation to the hot expansion depends on the details of reheating, but we can still get the general idea about how this exit appears. The Friedmann equation can be rewritten as

\[
H = -\frac{d\Phi/dt}{\Phi} + \sqrt{\frac{(d\Phi/dt)^2}{\Phi} + \frac{\rho}{3\Phi^2}},
\]

(1)

where \( \rho \) is the sum of \( \rho_\Phi = -(d\Phi/dt)^2/(2\xi^2) + V \) and the density of radiation \( \rho_r \), and we have neglected the contribution from the direct interaction between \( \phi \) and radiation. At the early time of oscillation, \( \rho_r \) can be neglected, bounces happen at the point \( \rho_\Phi = 0 \). The density \( \rho_\Phi \) itself also oscillates around the zero point with damped amplitude and reheating speeds up the damping. Meanwhile \( \rho_r \) increases with time. When it becomes significant, \( H \) in Eq. (1) becomes positive definitely, the oscillation stops and the universe enters into the smooth expanding phase. Reheating finishes at the moment of \( \Phi = 1 \) and \( \rho_\Phi = 0 \), so that Eq. (1) becomes \( H = \sqrt{\rho_\gamma/3} \). This is the familiar

Fig. 1. The evolution of \( \Phi \). Parameters are not changed. We used the cosmic time \( t \) instead of the conformal time \( \eta \).
Friedmann equation of the hot expanding universe in general relativity.

In addition, two typos were found in the old version: The stress-energy tensor following the equation (4) should be $T^{\mu\nu} = -P g^{\mu\nu} + P \nabla^\mu \phi \nabla^\nu \phi$; The action in the equation (20) is corrected as $S = \int d^4x \sqrt{\bar{g}} \left\{ \frac{1}{2} \bar{R} + \frac{1}{2} \bar{g}^{\mu\nu} \partial_{\mu} \phi \bar{\partial}_{\nu} \phi - V_0 \exp(-\beta \sqrt{\frac{1+\alpha}{6\alpha}} \phi) \right\}$.

The general conclusions of the paper are unchanged.

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