Erratum: Backreaction of particle production on false vacuum decay [Phys. Rev. D **93**, 025024 (2016)]

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According to [1], we noticed that the prefactor C in Eq. (17) is not a constant but a τ -dependent c number $C(\tau)$. Thus, Eq. (17) should read as

$$|\phi(\tau)\rangle = \mathcal{X}_\tau |O_\tau\rangle = C(\tau) \exp\left(\frac{1}{2} \sum_{\alpha,\beta} D_{\alpha\beta}(\tau) a_{\alpha,\tau}^\dagger a_{\beta,\tau}^\dagger\right) |O_\tau\rangle. \quad (17)$$

Consequently, footnote 7 must be omitted, and the prefactor $|C(0)|^2 := |C(\tau=0)|^2$ has to be inserted in both Eqs. (36) and (51) as follows:

$$\frac{\Gamma_{\text{Ba}}}{\mathcal{V}} = \frac{\hat{\rho}_r(0)}{\hat{\rho}_r(-\infty)} = |C(0)|^2 e^{-S_B} \frac{\mathcal{F}(0)}{\mathcal{F}(-\infty)}, \quad (36)$$

and

$$\frac{\Gamma_{\text{Ba}}}{\mathcal{V}} = \frac{|C(0)|^2 e^{-S_B}}{\sqrt{\text{Det}(1 - D_{\tau=0}^2)}} = |C(0)|^2 e^{-S_B - \frac{1}{2} \text{Tr} \ln(1 - D_{\tau=0}^2)}. \quad (51)$$

As explained in [1], this prefactor $|C(0)|^2$ can be evaluated from the path integral method of Callan and Coleman [2]. It corresponds to the subleading effect of one-loop quantum fluctuations of the field ϕ on the decay probability of the field σ .

On the other hand, the backreaction of the real ϕ particles on the decay rate of σ is not modified by the above correction and is still given by the expression $[\text{Det}(1 - D_{\tau=0}^2)]^{-1/2}$. Therefore, our interpretation of the backreaction of particle production and its effects on the semiclassical decay rate e^{-S_B} remain unchanged.

[1] V. A. Rubakov, *Nucl. Phys.* **B245**, 481 (1984).

[2] C. G. J. Callan and S. R. Coleman, *Phys. Rev. D* **16**, 1762 (1977).