Erratum: New Semiclassical Picture of Vacuum Decay [Phys. Rev. Lett. 123, 031601 (2019)]

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Inconsistency between Fig. 2 of the Letter and a similar plot in another publication [1] caused us to carefully re-examine all of our code. Closer inspection of the plotting routines revealed an inadvertent rescaling of the ϕ_0 values by a factor of $1/2$ for the orange dots (i.e., simulation results) in Fig. 2, which changes the plotted slope of $\ln \Gamma$ by a factor of $1/4$. This has the same effect as artificially adjusting the fluctuation amplitudes, as suggested in Hertzberg *et al.* [1]. The corrected figure is shown below.

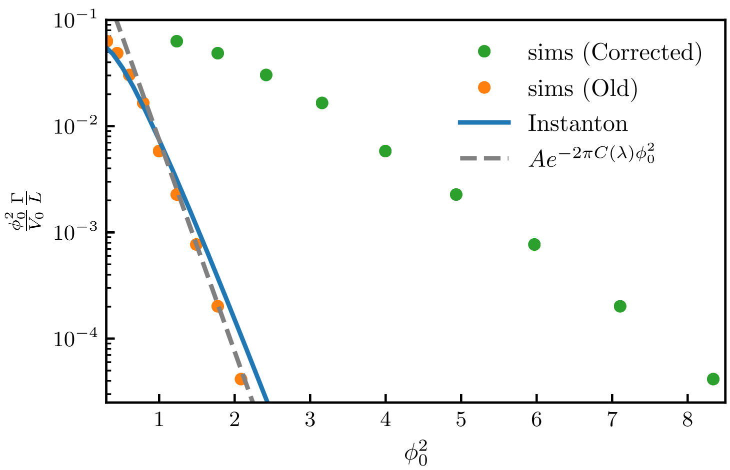

FIG. 1. Updated version of Fig. 2 from the Letter. The orange dots, blue solid and gray dashed lines are the same as described in the Letter. The green dots are the simulation results with the correct scaling.

Since both the real-time and instanton formalisms are approximating the same physical process to the same order in $\hbar$, one would expect them to give similar results, as we argued in the appendix of the Letter. The corrected result instead leads us to the surprising conclusion that the bubble nucleation rate obtained in the real-time approximation is larger than the prediction of the instanton formalism evaluated using the bare lattice potential to obtain the leading order estimate. In particular, within the parameter regimes explored in this study, the logarithm of the decay rate scales as ϕ_0^2, but the coefficient differs by a factor of approximately 4.

A possible explanation is a different account of corrections arising from quantum fluctuations between the real-time and instanton formalism, as already mentioned in the Letter. For example, the leading order potential used to obtain the instanton prediction may require radiative corrections to connect with the potential appearing in the lattice equations of motion. For example, with the parameters used in the Letter, the effective false vacuum mass receives a ϕ_0 dependent correction $\Delta m^2 \sim -2\phi_0^{-2}$. As shown in our recent work [2], recomputing the Euclidean action using effective potentials consistent with the renormalized masses as the false and true vacua can lead to changes in the slope of the decay rate, although further work on the precise form of the effective potential is necessary to make a quantitative statement.

With these changes, the importance of more work in this area is made even more evident. Our demonstration in the Letter of the existence of classical decay channels for false vacuum decays is unaltered. The corrected result for the decay rates provides further motivation to explore the interpretation of these decay trajectories and their relationship to existing approaches.

[1] M. P. Hertzberg, F. Rompineve, and N. Shah, Phys. Rev. D **102**, 076003 (2020).
[2] J. Braden, M. C. Johnson, H. V. Peiris, A. Pontzen, and S. Weinfurtner, arXiv:2204.11867.