Erratum: Wormhole nucleation via topological surgery in Lorentzian geometry [Phys. Rev. D 112, 064067 (2025)]

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(Received 20 April 2026; published 22 May 2026)

DOI: 10.1103/52c6-mfjp

We report minor corrections to the article; these do not affect the article's validity or conclusions and are as follows:

(i) In Fig. 1's caption, $S^1 \times S^2$ should be $D^1 \times S^2$.

(ii) In Sec. III.B, the sum in the equation after (6) should start from zero $j = 0$.

(iii) In Sec. III.E, $w_2(M)$ should be $w_2(W)$, and $\mathrm{Spin}^c(4)$ should be $\mathrm{Spin}^c(1,3)$.

(iv) In Sec. IV.C, U_2 and U_3 in Eq. (20) should read

$$U_2 : \ -\zeta_1^2 \partial_{\zeta_1} - (1 + \zeta_1 \zeta_2)\partial_{\zeta_2},$$
$$U_3 : \partial_{\xi_1} - \xi_1 \partial_{\xi_2},$$

and in Eq. (21) they should read

$$U_2 : (b^2 - a^2)\partial_a - 2ab\partial_b - (ac - bd + 1)\partial_c - (ad + bc)\partial_d,$$
$$U_3 : \partial_\alpha - \alpha\partial_\gamma - \beta\partial_\delta.$$

(v) Theorem IV.2 should include the following additional condition:
Let ξ^μ be a vector field such that $\mathcal{L}_\xi V_\mu = \alpha V_\mu$, for some smooth function α.

The second part of the proof should then read
Conversely, assume $\mathcal{L}_\xi g^L_{\mu\nu} = 0$. Then $\mathcal{L}_\xi g^R_{\mu\nu} = 4\alpha V_\mu V_\nu$. By construction, $0 = \mathcal{L}_\xi (g_R^{\mu\nu} V_\mu V_\nu) = -2\alpha$, so $\alpha = 0$. Hence $\mathcal{L}_\xi V_\mu = 0$ and $\mathcal{L}_\xi g^R_{\mu\nu} = 0$.

In the discussion that follows, the statement "metric (22) has no Killing vectors" should be replaced with "metric (22) has no obvious Killing vectors." At the end of the paragraph, the following should be added: "Indeed, it is possible to prove that (22) has no Killing vectors. In the U_3 chart, if a Killing vector field ξ^μ existed, then $\mathcal{L}_\xi R_{\mu\nu\rho\sigma} = 0$ would imply that, at the origin $\mathbf{0}$, $\xi^\mu|_{\mathbf{0}} = 0$ and $(\nabla_\mu \xi_\nu)|_{\mathbf{0}} = 0$. It then follows that ξ^μ must vanish identically [1]."

(vi) In Sec. V.B, $\dot{b}(\tau_1)$ is missing the prefactor $\sqrt{\Lambda/6}$.

(vii) In Sec. V.C, the correct form of metric (34) is $\mathrm{d}s^2_{\mathrm{Flat}} + \xi^2(\cos(2\psi)\mathrm{d}\xi - \xi\sin(2\psi)\mathrm{d}\psi)^2$, so that $\beta(\sigma_1) = \xi_1$ and $\dot{\beta}(\sigma_1) = 1$.

(viii) In Sec. V.D, the first formula in Eq. (40) should read $2a(\tau_0) = \alpha(\sigma_0) = R$. The homotopy $H_2(\eta, x^\mu)$ contains factors $z^{c(\eta)}$ that must be replaced by $c(\eta)(z-1)+1$.

[1] R. M. Wald, *General Relativity* (University of Chicago Press, Chicago, 1984), p. 442.

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