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Erratum: Designing Yang-Mills Topological Vacua with Cold Atoms [Chin. Phys. Lett. 43 040602 (2026)]

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This erratum corrects errors in my original paper [1]: the two-dimensional results in this paper are incorrect.

In the original text, equation (13) states that for a closed loop at a fixed radius r, the Wilson loop is

$$\Gamma_r = \mathcal{P}\exp\left(\mathrm{i}\oint_{\mathrm{C}} A_\varphi \,\mathrm{d}\varphi\right) = \mathrm{e}^{-\mathrm{i}\gamma(r)\sigma_z}, \tag{1}$$

with $\gamma(r) = 2\pi\sin^2[2n\arctan(r)]$. This expression is incorrect. A direct calculation of the gauge potentials given in Eqs. (10) and (11) of the original paper yields

$$\Gamma_r = \mathcal{P}\exp\left(\mathrm{i}\oint_{\mathrm{C}} A_\varphi \,\mathrm{d}\varphi\right) = \mathbb{I}_2, \tag{2}$$

where $\mathbb{I}_2$ is the 2×2 identity matrix, for all r. The underlying reason is that the homotopy group $\pi_1(SU(N)) = \{0\}$ precludes the existence of topologically nontrivial phase in two-dimensional space in the manner I proposed. Consequently, the Wilson loops in Eqs.(13) and (20) are trivial, and the associated discussion do not correspond to any physical observable in this system.

All results and conclusions for three-dimensional topological vacua of the original paper, including the experimental proposals and the new family of vacua with topological number nl, remain unchanged and are unaffected by this correction.

I am grateful to my Ph.D. student Qidong Wang for initially bringing this error to my attention.

References

[1] Zhu S L 2026 *Chin. Phys. Lett.* **43** 040602

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