that the joint constraint on $n_{\mathcal{R}}$ and r becomes a little tighter. The WMAP7+BAO+H_0 data do not constrain n_T. Basically all values allowed by the prior are also allowed by the potential and the coupling.

In Fig. 2 we plot the values of $n_{\mathcal{R}}$ and r in the models with $n = 2$ (top panel) and $n = 4$ (bottom panel) for different values of N and α. We can see that the model parameter α can shift the predicted r vertically for a fixed number of e-folds. For $n = 2$, the model with a positive α is more favored observationally. For $n = 4$, the model with $\alpha > 0.7$ is consistent with the data within the 95% confidence level, in which the prediction for the tensor-to-scalar ratio is smaller than the $\alpha = 0$ case while the prediction for $n_{\mathcal{R}}$ is the same as the $\alpha = 0$ case. Other ways to avoid the exclusion of the ϕ^4 potential have been studied in Ref. [18].

V. CONCLUSIONS AND DISCUSSIONS

In this paper we have studied slow-roll inflation with a nonminimally coupled Gauss-Bonnet term. We have defined a combined hierarchy (ϵ_i, δ_i) of Hubble and GB flow functions such that $|\epsilon_i| \ll 1$ and $|\delta_i| \ll 1$ is the analogue of the standard slow-roll approximation. It has been demonstrated that slow-roll solution is the attractor solution under the slow-roll condition. We have analytically derived the power spectra of scalar and tensor perturbations. In general the spectral index of scalar perturbations depends on the Hubble flow parameters and the GB flow parameters. However, the spectral index of tensor perturbations is independent of the GB flow parameters to first order in the slow-roll approximation. In this scenario the standard consistency relation does not hold because of the GB correction.

We apply our general formalism to large-field inflation with a monomial potential and the GB coupling (49). We focus on the case of $\omega = 1$ and $\alpha < 1$ since the field theory of phantom-type fields encounters the problem of stability. In this case, the GB term with the positive (or negative) coupling slows down (or speeds up) the evolution of the inflaton during inflation, which decreases (or increases) the energy scale of the potential to be in agreement with the amplitude of scalar perturbations. However the amplitude of tensor perturbations only depends on the energy scale of the potential at the horizon-crossing time. Therefore, the tensor-to-scalar ratio is suppressed for $\alpha > 0$ while it is enhanced for $\alpha < 0$.

As shown in Fig. 2, the model parameter α can shift the predicted r vertically for a fixed number of e-folds in the $n_{\mathcal{R}}$-r plane. For $n = 2$, the quadratic potential can be made a better fit to the data by the positive GB coupling. For $n = 4$, it is known that the model with $\alpha = 0$ is excluded by the WMAP7+BAO+H_0 analysis. However, in our scenario of inflation $\alpha > 0.7$ is within the 2σ contour for $N > 50$, and it is consistent with the data within the 95% confidence level.

The results of this work are generic as soon as nonminimal couplings are considered. While it is always possible by means of a conformal transformation to work in the Einstein frame and to avoid the presence of a $\phi^2 R$ term in the Lagrangian, the coupling of the scalar field to the GB term cannot be argued away by the same conformal transformation. While we studied perturbation spectra in the Einstein frame, similar properties hold in the Jordan frame.

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