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**Primordial magnetic field generated in natural inflation.** (English) Zbl 1329.83201  
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Summary: We study the simple gauge invariant model  $f^2FF$  as a way to generate primordial magnetic fields (PMF) in natural inflation (NI). We compute both magnetic and electric spectra generated by the  $f^2FF$  model in NI for different values of model parameters and find that both de Sitter and power law expansion lead to the same results at sufficiently large number of e-foldings. We also find that the necessary scale invariance property of the PMF cannot be obtained in NI in first order of slow roll limits under the constraint of inflationary potential,  $V(0) \simeq 0$ . Furthermore, if this constraint is relaxed to achieve scale invariance, then the model suffers from the backreaction problem for the co-moving wave number,  $k \lesssim 8.0 \times 10^{-7} \text{Mpc}^{-1}$  and Hubble parameter,  $H_i \gtrsim 1.25 \times 10^{-3} \text{M}_{\text{Pl}}$ . The former can be considered as a lower bound of  $k$  and the later as an upper bound of  $H_i$  for a model which is free from the backreaction problem. Further, we show that there is a narrow range of the height of the potential  $\lambda$  around  $\lambda_{\text{min}} \approx 0.00874 \text{M}_{\text{Pl}}$  and of  $k$  around  $k_{\text{min}} \sim 0.0173 \text{Mpc}^{-1}$ , at which the energy of the electric field can fall below the energy of the magnetic field. The range of  $k$  lies within some observable scales. However, the relatively short range of  $k$  presents a challenge to the viability of this model.

**MSC:**

[83F05](#) Cosmology  
[85A40](#) Cosmology  
[83C22](#) Einstein-Maxwell equations  
[78A25](#) Electromagnetic theory, general

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**Keywords:**

[inflation](#); [primordial magnetic field](#); [inflationary models](#)

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