European Physical Journal C 2012 vol.72 N2, pages 1-14

Gradient models of the axion-photon coupling

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Abstract

We establish an extended version of the Einstein-Maxwell-axion model by introducing into the Lagrangian cross-terms, which contain the gradient four-vector of the pseudoscalar (axion) field in convolution with the Maxwell tensor. The gradient model of the axion-photon coupling is applied to cosmology: we analyze the Bianchi-I type Universe with an initial magnetic field, electric field induced by the axion-photon interaction, cosmological constant and dark matter, which is described in terms of the pseudoscalar (axion) field. Analytical, qualitative and numerical results are presented in detail for two distinguished epochs: first, for the early Universe with magnetic field domination; second, for the stage of late-time accelerated expansion. © Springer-Verlag / Società Italiana di Fisica 2012.

http://dx.doi.org/10.1140/epjc/s10052-012-1895-3