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Effective metrics in the non-minimal Einstein–Yang–Mills–Higgs theory

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ABSTRACT

We formulate a self-consistent non-minimal five-parameter Einstein–Yang–Mills–Higgs (EYMH) model and analyse it in terms of effective (associated, color and color-acoustic) metrics. We use a formalism of constitutive tensors in order to reformulate master equations for the gauge, scalar and gravitational fields and reconstruct in the algebraic manner the so-called associated metrics for the Yang–Mills field. Using WKB-approximation we find color metrics for the Yang–Mills field and color-acoustic metric for the Higgs field in the framework of five-parameter EYMH model. Based on explicit representation of these effective metrics for the EYMH system with uniaxial symmetry, we consider cosmological applications for Bianchi-I, FLRW and de Sitter models. We focus on the analysis of the obtained expressions for velocities of propagation of longitudinal and transversal color and color-acoustic waves in a (quasi)vacuum interacting with curvature; we show that curvature coupling results in time variations of these velocities. We show, that the effective metrics can be regular or can possess singularities depending on the choice of the parameters of non-minimal coupling in the cosmological models under discussion. We consider a physical interpretation of such singularities in terms of phase velocities of color and color-acoustic waves, using the terms "wave stopping" and "trapped surface".

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