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Anisotropic Scalar Field Dark Energy with a Disformally Coupled Yang-Mills Field

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In the context of quintessence, the inclusion of new degrees of freedoms to the matter sector might produce additional imprints on cosmological observables while keeping the scalar field responsible for the quintessence and the standard matter minimally coupled to gravity. We investigate this premise by including a canonical $SU(2)$ Yang-Mills field to the total content of the universe coupled to the standard quintessence field by a disformal transformation. The background dynamics study is addressed by a dynamical system analysis from which novel anisotropic scaling solutions with a non-vanishing gauge field are obtained. An interesting result to be confronted with observations is a transient matter-radiation phase for the gauge field dynamics. We have also quantified the redshift-dependent contribution of the gauge field in the form of dark radiation during the radiation era to the effective number of relativistic species. This depends essentially on the initial conditions and, more importantly, on the disformal coupling function. Phenomenological couplings and the Abelian version of the model are discussed as well to check the generality of our results.

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