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Dark energy from vector gauge fields

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In this work, we study a dark energy model solely based on gauge vector fields, coupled to dark matter. We use the dynamical system approach to investigate the stability of this proposal and identify both, scaling and late-time accelerating solutions. Then, we numerically integrate the equations that characterize the dynamics of the model to verify the results of the previous analysis and identify the particular evolution of the universe predicted for this model. The action of the model is

$$S = \int d^4x\sqrt{-g}\Big[\frac{1}{2}M_P^2 R - \frac{1}{4}F^a_{\mu\nu}F_a^{\mu\nu} - V(X) + f(X,Y)\mathcal{L}_{mat} + \mathcal{L}_r + \mathcal{L}_b\Big],$$

where g is the determinant of the metric $g_{\mu\nu}$, M_P is the reduced Planck mass, R is the Ricci scalar, $F^a_{\mu\nu}$ is the field strength tensor, $V(X)$ is the potential of the field, $f(X,Y)$ is a function that couples the gauge field with the dark matter, $X = A^a_\mu A^\nu_a$ and $Y = F^a_{\mu\nu}F_a^{\mu\nu}$. $\mathcal{L}_{mat}$, $\mathcal{L}_r$, and $\mathcal{L}_b$ are the Lagrangians densities for dark matter, baryonic matter and radiation fluids, respectively.

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