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Cosmological implications of Weyl geometric gravity

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We investigate the dark energy in the Weyl geometric gravity, which is based on the introduction of a Weyl connection to describe the gravitational properties of the space-time. We consider the case in which the Lagrangian is given by the sum of the square of the Weyl scalar, of the strength of the field associated to the Weyl vector, and a conformally invariant geometry-matter coupling term, constructed from the matter Lagrangian and the Weyl scalar. The action is linearized in the Ricci scalar by introducing an auxiliary scalar field. After substituting the Weyl scalar in terms of its Riemannian counterpart, the quadratic Wedyl action is defined in Riemann geometry, and involves a nonminimal coupling between geometry and matter. The field equations are obtained by varying the action with respect to the metric, the scalar field, and the Weyl vector. The cosmological implications of the Weyl geometric gravity field equations are investigated for different forms of the Weyl vector-matter Lagrangian coupling functions. From the generalized Friedmann equations of the model, obtained by assuming that the background Riemannian metric is of the Friedmann- Lemaitre-Robertson-Walker type, an effective geometric dark energy component can be generated, with the effective, geometric type pressure. A comparison with the standard ΛCDM model is also performed, and we find that the Weyl geometric gravity type cosmological models can give an acceptable description of the cosmological observations.

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