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Linear Perturbations and SVT Decomposition in Higher-Order Quadratic Gravity

In this work, we present the formulation of linear perturbations in higher-order gravity theories, whose action includes terms R , R^2 , and R

BoxR. The perturbed metric and the energy-momentum tensor are decomposed into scalar, vector, and tensor modes (SVT decomposition), allowing the independent analysis of each type of perturbation. We consider the gauge invariants Φ , Ψ , and Ξ_i , which derive from the perturbed metric. The goal is to provide a basic set of formulas for the study of these perturbations (Φ , Ψ , Ξ_i and h_{ij}^{TT}) both in the presence of matter and in vacuum, with the purpose of studying gravitational waves. This formulation can be applied to the analysis of the polarization modes of gravitational waves and to the study of waveforms generated by astrophysical systems, such as binary systems of compact objects.

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