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Cosmology in genealized Proca theories and beyond

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We consider a massive vector field with derivative interactions that propagates only the 3 desired polarizations (besides two tensor polarizations from gravity) with second-order equations of motion in curved space-time. The cosmological implications of such generalized Proca theories are investigated for both the background and the linear perturbation by taking into account the Lagrangian up to quintic order. In the presence of a matter fluid with a temporal component of the vector field, we derive the background equations of motion and show the existence of de Sitter solutions relevant to the late-time cosmic acceleration. We also obtain conditions for the absence of ghosts and Laplacian instabilities of tensor, vector, and scalar perturbations in the small-scale limit. Our results are applied to concrete examples of the general functions in the theory, which encompass vector Galileons as a specific case. In such examples, we show that the de Sitter fixed point is always a stable attractor and study viable parameter spaces in which the no-ghost and stability conditions are satisfied during the cosmic expansion history.

We also construct higher-order derivative interactions beyond second-order generalized Proca theories that propagate only the three desired polarizations of a massive vector field besides the two tensor polarizations from gravity.

Summary

Primary author: TSUJIKAWA, Shinji (Tokyo University of Science)

Presenter: TSUJIKAWA, Shinji (Tokyo University of Science)

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