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The screening Horndeski cosmologies

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We present a systematic analysis of homogeneous and isotropic cosmologies in a particular Horndeski model with Galileon shift symmetry, containing also a Λ-term and a matter. The model, sometimes called Fab Five, admits a rich spectrum of solutions. Some of them describe the standard late time cosmological dynamic dominated by the Λ-term and matter, while at the early times the universe expands with a constant Hubble rate determined by the value of the scalar kinetic coupling. For other solutions the Λ-term and matter are screened at all times but there are nevertheless the early and late accelerating phases. The model also admits bounces, as well as peculiar solutions describing "the emergence of time". Most of these solutions contain ghosts in the scalar and tensor sectors. However, a careful analysis reveals three different branches of ghost-free solutions, all showing a late time acceleration phase. We analyse the dynamical stability of these solutions and find that all of them are stable in the future, since all their perturbations stay bounded at late times. However, they all turn out to be unstable in the past, as their perturbations grow violently when one approaches the initial spacetime singularity. We therefore conclude that the model has no viable solutions describing the whole of the cosmological history, although it may describe the current acceleration phase. We also check that the flat space solution is ghost-free in the model, but it may acquire ghost in more general versions of the Horndeski theory.

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