Minimal theory of massive gravity

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We investigate the minimal theory of massive gravity (MTMG) recently introduced. After reviewing the original construction based on its Hamiltonian in the vielbein formalism, we reformulate it in terms of its Lagrangian in both the vielbein and the metric formalisms. It then becomes obvious that, unlike previous attempts in the literature, not only the potential but also the kinetic structure of the action is modified from the de Rham-Gabadadze-Tolley (dRGT) massive gravity theory. We confirm that the number of physical degrees of freedom in MTMG is two at fully nonlinear level. This proves the absence of various possible pathologies such as superluminality, acausality and strong coupling. Afterwards, we discuss the phenomenology of MTMG in the presence of a dust fluid. We find that on a flat homogeneous and isotropic background we have two branches. One of them (self-accelerating branch) naturally leads to acceleration without the genuine cosmological constant or dark energy. For this branch both the scalar and the vector modes behave exactly as in general relativity (GR). The phenomenology of this branch differs from GR in the tensor modes sector, as the tensor modes acquire a non-zero mass. Hence, MTMG serves as a stable nonlinear completion of the self-accelerating cosmological solution found originally in dRGT theory. The other branch (normal branch) has a dynamics which depends on the time-dependent fiducial metric. For the normal branch, the scalar mode sector, even though as in GR only one scalar mode is present (due to the dust fluid), differs from the one in GR, and, in general, structure formation will follow a different phenomenology. The tensor modes will be massive, whereas the vector modes, for both branches, will have the same phenomenology as in GR.