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Contributory: Aspects of Spontaneous Symmetry Breaking in Cosmology

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We explore if a late-time cosmic acceleration and a mild variation of fundamental constants can be accommodated within a common scalar-tensor framework. The fundamental constants we focus on are the Newtonian gravitational coupling G and the electron mass m_e . The scalar-tensor framework under consideration is a generalized Brans-Dicke theory with an additional matter field. The viability of this framework is explored in the context of well-established late-time cosmic expansion history, namely, a standard Λ CDM expansion and an extended Λ CDM expansion (where a rational (Pad\`e-like) deformation is considered). We reconstruct and show that the resulting effective potential of the matter field naturally develops a Higgs-like symmetry-breaking structure with a redshift-dependent mass term, leading to a mild evolution of the vacuum expectation value. This variation leads to an evolution of proton-to-electron mass ratio μ which is compared with observational bounds derived from quasar absorption spectra. We find that in order to accommodate a reasonably mild variation of μ , the Brans-Dicke scalar field must behave as a chameleon.

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