

Luminal scalar-tensor theories via couplings to photons

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The detection of GW170817 and its electromagnetic counterpart placed a stringent bound on the difference between the speeds of gravitational waves and light, severely restricting viable scalar-tensor models of dark energy. In particular, large parts of Horndeski and beyond Horndeski theories appeared to be ruled out as a description of late-time cosmic acceleration. In this talk we revisit this conclusion. We argue that the constraint concerns the relative propagation of gravitons and photons, so a consistent treatment must include possible interactions between the dark energy scalar and the electromagnetic sector. Using Kaluza–Klein reductions of higher-dimensional scalar-tensor theories as a guiding principle, we construct classes of self-consistent scalar–vector–tensor theories within the DHOST framework in which gravitational waves and light propagate with equal speeds on cosmological backgrounds. We discuss which of these couplings cannot be removed by conformal or disformal field redefinitions, the fate of gravitational wave decay into dark energy, and the implications for screening mechanisms and observational tests.

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