Investigating gravitational wave propagation and phenomenology in (beyond)-Horndeski theories after GW170817 .

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We constructed a new class of quintic Horndeski theories with the property that on flat FRW backgrounds gravitational waves propagate exactly with the speed of light, c^2_gw = 1.
Such theories became increasingly interesting after the LIGO/Virgo discovery of GW170817 that implied that any deviation between these propagation speeds |c^2_gw - 1| has to be smaller than 10^-15.
Quintic Horndeski theories with the property c^2_gw = 1 were previously claimed not exist. We discovered a loophole in these previous arguments giving rise to a new class of potentially viable theories.
However, considering the impact of scalar inhomogeneities on GW propagation using higher order perturbation theory, we discovered that these models are nevertheless excluded: already a Newtonian potential with amplitude 10^-5 will lead on average to | c^2_gw - 1| > 10^-7 for gravitational waves with frequencies relevant for LIGO/Virgo.

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