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GW waves and the triple Higgs boson coupling in the 2HDM

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Many popular extensions of the SM require sizeable modifications to the trilinear Higgs boson coupling in order to accommodate a first-order electroweak (EW) phase transition. Cosmological first-order phase transitions can give rise to a primordial gravitational wave (GW) background which could be observable at future space-based GW detectors such as LISA. Focusing on the Yukawa type-II 2HDM and taking into account various theoretical and experimental constraints in combination with the condition of the presence of a first-order EW phase transition, we scrutinize the relevant parameter space regions and verify whether these regions could be probed in a complementary way at the HL-LHC via nonresonant Higgs boson pair production and at the LISA experiment via the possible observation of a GW signal. We find regions of the parameter space that give rise to GW signals that might be detectable at LISA, and these regions predict values of the triple Higgs boson couplings that are potentially observable at the HL-LHC or other future colliders. The measurements of Higgs boson pair production will therefore provide important constraints on the possiblity of observing GW signals at LISA.

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