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Resonant Di-Higgs Production in the $b\bar{b}W^+W^-$ channel with W leptonic decays: Probing the Electroweak Phase Transition at the LHC
TAO HUANG, Texas AM — With the discovery of the Higgs boson at the LHC, exploring the thermal history associated with electroweak symmetry-breaking (EWSB) has taken on heightened interest. The process of EWSB in the early Universe, the electroweak phase transition, provides conditions able to explain the observed cosmic matter-antimatter asymmetry, if the transition were of first order and sufficiently strong. The prospects for resonant di-Higgs production searches at LHC, in the context of probing the electroweak phase transition, will be presented. We explore the sensitivity of the $b\bar{b}W^+W^-$ channel, with W leptonic decays. The presence of neutrinos in the final state do not allow the reconstruction of the invariant mass of the heavy scalar, diminishing the sensitivity of this channel. We present a novel technique, called High Mass Estimator (HME), that allows to fully reconstruct the kinematic of the process, and therefore to reconstruct the heavy Higgs invariant mass. We prove that, with HME technique, this channel can be sensitive as much as $b\bar{b}b\bar{b}$, $b\bar{b}\gamma\gamma$, and $b\bar{b}\tau\tau$ channels, leading to a potential discovery of resonant di-Higgs production with the datasets accumulated in High Luminosity phase of LHC, foreseen in 2035

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