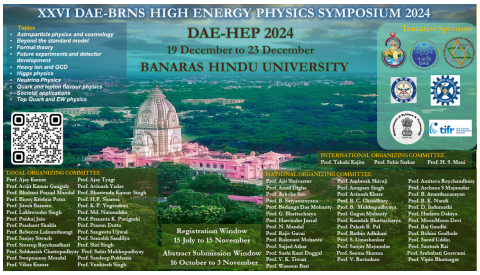

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Probing electroweak phase transition in extended singlet scalar model with resonant HH production in bbZZ channel using parameterized machine learning

In this paper, a collider signature of a heavy Higgs boson at 14 TeV HL-LHC is studied, where the heavy Higgs boson decays into a pair of standard model (SM) Higgs boson, which further decays to $bbZZ$ state and subsequently to bb^{+-} final state. To study this, we consider singlet scalar extension of the SM and select the parameter space and mass of the heavy Higgs boson such that it prefers a strong first-order electroweak phase transition (EWPT). The study is done following the $bbZZ$ analysis of CMS Collaboration and further using parameterized machine learning for final discrimination which simplifies the training process along with an improved discrimination between signal and background over the range of benchmark points. Despite the lower branching fraction, this channel can be a potential probe of the EWPT with the data sets collected by the CMS and ATLAS experiments at the 14 TeV HL-LHC with $3\,\mathrm{ab}^{-1}$ of integrated luminosity and a production of resonant di-Higgs signal can be potentially discovered up to 490 GeV of resonance mass.

Field of contribution

Phenomenology

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