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Complementarity between Higgs searches at the LHC and Gravitational Waves signals

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The Higgs boson was postulated as a key component of the Standard Model (SM) of particle physics to explain the origin of mass. After 45 years of rigorous experimental searches, the Higgs boson was finally discovered on July 4th, 2012 at the CERN Large Hadron Collider (LHC). The discovery of the Higgs boson completes the SM and confirm one of its most mysterious predictions. The SM, although very effective, fails to address many important questions of nature. In this talk, I will discuss how the newly discovered Higgs boson is connected with one of the most critical puzzles of the nature that is not explained by the SM - how the asymmetry between matter and antimatter was created in the early universe? A first order phase transition is an out-of-equilibrium process, and this is needed for the generation of the observed baryon asymmetry (as stated by the third Sakharov condition). However, the newly discovered 125 GeV Higgs boson by itself cannot bring about a first-order phase transition, but an additional real singlet scalar field added to the SM can. Such strongly first-order phase transition in the early universe can also generate gravitational waves signals observable at future space-based interferometers like LISA. On the other hand, the presence of the additional scalar particle in the model will lead to interesting signatures of physics beyond the SM at the LHC. In this talk, I will discuss the possibility for complementary searches for electroweak phase transition in collider and gravitational wave experiments within the SM augmented by a real singlet scalar.

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