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Testing leptogenesis from observable gravitational waves

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Leptogenesis provides an elegant mechanism to explain the observed baryon asymmetry of the Universe (BAU), yet its experimental verification remains challenging due to requirements of either extremely heavy right-handed neutrinos or precisely fine-tuned mass splittings.
We present a scenario where an additional scalar field, coupled to both the Higgs and right-handed neutrinos (RHNs), enhances the CP asymmetry through loop-level contributions, enabling successful leptogenesis at the electroweak scale. This same scalar sector triggers a strong first-order electroweak phase transition (EWPT), producing gravitational waves (GWs) within the reach of next-generation detectors. We demonstrate a robust correlation between the BAU and GW signal strength, offering a concrete path to experimentally probe leptogenesis at future GW observations.

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