

Baryogenesis in the 2HDM+a

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There are a multitude of Standard Model (SM) extensions that accommodate an electroweak first-order transition (EWFOPT) in the Early Universe, with the aim of providing an explanation for the observed baryon asymmetry of the Universe (BAU). Using a well-known SM extension featuring two Higgs doublets and a SM-singlet pseudoscalar (2HDM+a) that evades electric dipole moment (EDM) constraints, we investigate regions of parameter space that may potentially produce the observed BAU and their resulting interplay with theoretical and experimental collider constraints. More specifically, the BAU is realised via transitional CP-violation during a strong first-order phase transition, and, we provide upper and lower bounds on the BAU across parameter space by bounding the wall velocity of the bubble walls that occur during the transition. The 2HDM+a can readily accommodate the observed BAU, however, our results highlight why common assumptions and estimates used to calculate the BAU in the literature can become inaccurate and often overestimate its magnitude.

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