

nuEWBG: The scalar potential strikes back

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We perform a comprehensive scan of the parameter space of a general singlet scalar extension of the Standard Model to identify the regions which can lead to a strong first-order phase transition, as required by the electroweak baryogenesis mechanism. We find that taking into account bubble nucleation is a fundamental constraint on the parameter space and present a conservative and fast estimate for it so as to enable efficient parameter space scanning. The allowed regions turn out to be already significantly probed by constraints on the scalar mixing from Higgs signal strength measurements. We also consider the addition of new neutrino singlet fields with Yukawa couplings to both scalars and forming heavy (pseudo)-Dirac pairs, as in the linear or inverse Seesaw mechanisms for neutrino mass generation. We find that their inclusion does not alter the allowed parameter space from early universe phenomenology in a significant way. Conversely, there are allowed regions of the parameter space where the presence of the neutrino singlets would remarkably modify the collider phenomenology, yielding interesting new signatures in Higgs and singlet scalar decays.

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