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# First Order Electroweak Phase Transitions in the SM with a Real Scalar Singlet Extension

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We investigate an extension of the standard model (SM) with a real scalar singlet without $\mathbb{Z}_2$ symmetry, requiring a first order electroweak phase transition (FOPT) to occur to satisfy the condition for electroweak baryogenesis. We perform numerical calculations that include one-loop thermal effects and Coleman-Weinberg corrections with daisy resummation. The bubble nucleation temperature is calculated for potentials that are able to drive tunneling through thermal fluctuations. Our numerical scan looks at singlet masses ($m_s$) between 0 and 5 TeV, requiring each point to satisfy current experimental, stability, and unitary constraints. We study the resulting parameter space for light ($m_s \leq m_h/2$), intermediate ($m_h/2 < m_s < 2m_h$), and heavy ($2m_h \leq m_s$) singlet masses. In each region we explore the main modes of production, looking for complimentary modes in the parameter space to aid in di-Higgs precision measurements, noting the extra contributions from the one-loop effects.

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