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Fate of the Primordial Higgs Condensate

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If the Higgs potential remains close to the Standard Model prediction the light Higgs field gets locally displaced from vacuum during inflation. Observational ramifications of the primordial Higgs condensate crucially depend on its subsequent evolution. We discuss the relaxation of the condensate using analytical methods and numerical lattice computations. The dominant decay channel is the resonant production of weak gauge bosons where non-Abelian interactions play a crucial role. Unlike in the Abelian case, they quickly extend the momentum distribution towards high values, efficiently destroying the condensate after the onset of back-reaction. For inflation at the scale $H = 10^8$ GeV, we find that 90\% of the Higgs condensate has decayed after $n \sim 7$ oscillation cycles. This differs significantly from the Abelian case where, given the same couplings strengths, most of the condensate would persist after the resonance.

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