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Z_2 Non-Restoration and Composite Higgs: Singlet-Assisted Baryogenesis w/o Topological Defects

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Simple scalar extensions of the Standard Model (SM) with a spontaneously broken Z_2 symmetry allow for a strongly first order electroweak phase transition, as sought in order to realize electroweak baryogenesis. To avoid the emergence of phenomenologically problematic domain walls one may encounter in this context, in 2112.12087 (A. Angelescu, F. Goertz, AT), a scalar singlet framework featuring a thermal history which does not restore Z_2 in the early universe is proposed. This can be realized by introducing $D > 4$ operators in an effective field theory (EFT). A possible UV completion is provided by $SO(6)/SO(5)$ composite Higgs models, where the scalar potential and Yukawa interactions are obtained in spurion analyses and spontaneously CP-violating terms arise. The model with SM fermions in a symmetric $20'$ of $SO(6)$ is successfully matched to the envisaged EFT parameter space. The scenario can then fulfill all Sakharov criteria while accounting for the electroweak hierarchy problem.

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