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Multi-TeV Signals of Baryogenesis in Higgs Troika Model

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A modest extension of the Standard Model by two additional Higgs doublets - the Higgs Troika Model - can provide a well-motivated scenario for successful baryogenesis if neutrinos are Dirac fermions. Adapting the "Spontaneous Flavor Violation" framework, we consider a version of the Troika model where light quarks have significant couplings to the new multi-TeV Higgs states. Resonant production of new scalars leading to di-jet or top-pair signals are typical predictions of this setup. The initial and final state quarks relevant to the collider phenomenology also play a key role in baryogenesis, potentially providing direct access to the relevant early Universe physics in high energy experiments. Viable baryogenesis generally prefers some hierarchy of masses between the observed and the postulated Higgs states. We show that there is a complementarity between direct searches at a future 100 TeV pp collider and indirect searches at flavor experiments, with both sensitive to different regions of parameter space relevant for baryogenesis. In particular, measurements of $D - \bar{D}$ mixing at LHCb probe much of the interesting parameter space. Direct and indirect searches can uncover the new Higgs states up to masses of $\mathcal{O}(10)$ TeV, thereby providing an impressive reach to investigate this model.

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