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Multistep Strongly First Order Phase Transitions from New Fermions at the TeV Scale

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Despite the vast literature on first order Electroweak Phase Transitions (EWPT), which can provide the necessary conditions for generating the Baryon Asymmetry in the Universe, fermion-induced EWPTs still remain a rather uncharted territory. In this talk, we consider a simple fermionic extension of the Standard Model (SM) involving one $SU(2)_L$ doublet and two singlet Vector-Like Leptons (VLLs), strongly coupled to the Higgs scalar and with TeV-scale masses. We show how such a simple scenario can give rise to a non-trivial thermal history of the Universe, involving strongly first order multistep phase transitions occurring at temperatures close to the electroweak (EW) scale. Afterwards, we investigate the distinct Gravitational Wave (GW) signatures of these phase transitions at future GW detectors, such as LISA, and briefly discuss the LHC signatures of the VLLs. Finally, we compare the full model GW results with the ones obtained in an Effective Field Theory coming from integrating out the VLLs.

Primary authors: ANGELESCU, Andrei (University of Nebraska-Lincoln); HUANG, Peisi (Texas A&M University)

Presenter: ANGELESCU, Andrei (University of Nebraska-Lincoln)

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