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Stochastic Gravitational Wave Background from Chiral Symmetry Breaking in QCD-like Sectors

First-order cosmological phase transitions are among the most promising sources of a stochastic gravitational wave (GW) background in the frequency range accessible to next-generation detectors. In this work, we study the chiral phase transition in QCD-like theories, both in the Standard Model and in strongly coupled dark sectors, and characterize the associated GW spectrum.

Using the three-flavor linear sigma model (LSMq), we compute the parameters that determine the signal, namely the transition strength α and the inverse duration β/H, and obtain the resulting spectrum. We find that: (i) in Standard Model QCD, a first-order transition can occur when a topological angle $\theta = \pi$ is introduced, producing a GW spectrum; and (ii) in a dark QCD, the absence of hadronic constraints allows broad flexibility in the parameter space, yielding spectra that are potentially detectable at future experiments such as LISA, DECIGO, and BBO.

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