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Probing classically conformal B–L model with gravitational waves

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We study the cosmological history of the classical conformal B–L gauge extension of the standard model, in which the physical scales are generated via the Coleman-Weinberg-type symmetry breaking. Especially, we consider the thermal phase transition of the U(1)B–L symmetry in the early universe and resulting gravitational-wave production. Due to the classical conformal invariance, the phase transition tends to be a first-order one with ultra-supercooling, which enhances the strength of the produced gravitational waves. We show that, requiring (1) U(1)B–L is broken after the reheating, (2) the B–L gauge coupling does not blow up below the Planck scale, (3) the thermal phase transition completes in almost all the patches in the universe, the gravitational wave spectrum can be as large as ΩGW~10−8 at the frequency f~0.01-1Hz for some model parameters, and a vast parameter region can be tested by future interferometer experiments such as eLISA, LISA, BBO and DECIGO.

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