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Gravitational Waves and Dark Matter from Scale Symmetry Breaking

We present an updated analysis of the first-order phase transition associated with symmetry breaking in the early Universe in a classically scale-invariant model extended with a new SU(2) gauge group. Including recent developments in understanding supercooled phase transitions, we compute all of the model's characteristics and significantly constrain the parameter space. We then predict gravitational wave spectra generated during this phase transition. By computing the signal-to-noise ratio we conclude that this model is well-testable (and falsifiable) with LISA. We also provide predictions for the relic dark matter abundance. It is consistent with observations in a rather narrow part of the parameter space since we exclude the so-called supercool dark matter scenario based on an improved description of percolation and reheating after the phase transition as well as the inclusion of the running of couplings. Finally, we devote attention to the renormalisation-scale dependence of the results.

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