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Primordial gravitational waves produced in bouncing models

The primordial background of gravitational waves is investigated for a Universe with a bounce, i.e., a Universe that has a contraction before its expansion. The bounce is caused by quantum effects. It is shown the spectrum is scale dependent, which is different from the standard inflation models. The model investigated is evolved with three non-interacting fluids, with sound velocities equal to 0, 1/3 and almost 1. The primordial gravitational waves emerge from quantum tensorial fluctuations in the far past of the Universe. It is concluded that for low frequencies ($10^{-18} \sim 10^{-10} Hz$), the energy density is proportional to a power of the frequency, $f^{\frac{2(9\omega-1)}{1+3\omega}}$, where ω is the sound velocity of the dominant fluid when the wave crosses the Universe curvature scale, and amplitude of gravitational waves is related to the minimum size of the scale factor.

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