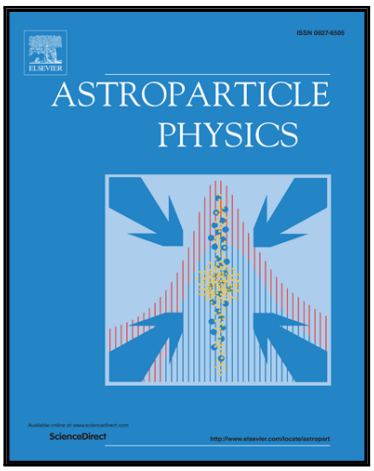

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Primordial gravitational waves in running vacuum cosmologies

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Abstract

We investigate the cosmological production of gravitational waves in a non-singular flat cosmology powered by a "running vacuum" energy density **described by $\rho_\Lambda \equiv \rho_\Lambda(H)$, a phenomenological expression potentially linked with the renormalization group approach in quantum field theory in curved spacetimes.** The model can be interpreted as a particular case of the class recently discussed by Perico et al. (Phys. Rev. D **88**, 063531, 2013) which is termed complete in the sense that the cosmic evolution occurs between two extreme de Sitter stages (early and late time de Sitter phases). **The gravitational wave equation is derived and its time-dependent part numerically integrated since the primordial de Sitter stage. The generated spectrum of gravitons is also compared with the standard calculations where an abrupt transition, from the early de Sitter to the radiation phase, is usually assumed.** It is found that the stochastic background of gravitons is very similar to the one predicted by the cosmic concordance model plus inflation except at higher frequencies ($\nu \gtrsim 100$ kHz). This remarkable signature of a "running vacuum" cosmology combined with the proposed high frequency gravitational wave detectors **and measurements of the CMB polarization (B-modes) may provide a new window to confront more conventional models of inflation.**

Keywords: gravitational waves, wave generation and sources, relativity and gravitation, cosmology