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Chiral gravitational wave background from axion-like fields in the early universe

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The chiral gravitational wave background (GWB) can be generated by axion-like fields in the early universe. The conventional notion of an audible axion relies on couplings between axions and gauge fields. Here we consider an axion-like mechanism coupled to the gravitational topological term, which enables direct and efficient production of gravitational waves during the radiation-dominated era of the early Universe. We compute the energy spectral density of the chiral gravitational wave background and the comoving energy density of axion-like fields. Using our numerical results, we explore the parameter space of axion masses and decay constants that yield detectable gravitational wave signals for both pulsar timing arrays and space-based gravitational wave detectors.[2604.08141 & 2412.18420].

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