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Gravitational Waves from Axions

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Axions are among the best motivated candidates for new physics. If the Peccei-Quinn symmetry associated with an axion has been ever restored after inflation, axion strings form and inevitably produce a contribution to the stochastic gravitational wave background. In this talk I will discuss the resulting gravitational wave spectrum by combining effective field theory analysis with numerical simulations. I will show that a single ultralight axion-like particle with a decay constant larger than 10^{14} GeV and any mass between 10^{-18} and 10^{-28} eV leads to an observable gravitational wave spectrum, and is compatible with constraints from dark matter overproduction, isocurvature and dark radiation. Since the spectrum extends over a wide range of frequencies, the resulting signal could be detected by multiple experiments. I will also comment on the recent NANOgrav signal in light of these results. Based on: 2101.11007.

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