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Efficient self-resonance instability from axions

It was recently shown that a coherent oscillation of an axion can cause an efficient parametric resonance, leading to a prominent emission of the gravitational waves (GWs). In this poster, conducting the Floquet analysis, we investigate the parametric resonance instability, which potentially triggers the emission of the GWs from axions. Such a resonance instability takes place, when the time evolution of the background field significantly deviates from the harmonic oscillation. Therefore, the resonance instability cannot be described by the Mathieu equation, whose stability/instability chart is well known. In this poster, introducing an explicitly calculable parameter $\tilde{q}$, which can be used to classify different types of the parametric resonance described by the general Hill's equation, we investigate the stability/instability chart for the general Hill's equation. This can also apply to the case where the background oscillation is anharmonic. We show that the flapping resonance instability, which takes place for $\tilde{q} = \mathcal{O}(1)$, typically leads to the most significant growth of the inhomogeneous modes among the self-resonance instability. We also discuss the nonlinear dynamics of the oscillating scalar field.

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