Contribution ID: **32** Type: **not specified**

Oscillon decay accelerated by coupling external scalar field

Tuesday, 8 July 2025 11:50 (20 minutes)

Oscillons are long-lived, spherically symmetric solitons that can arise in real scalar field theories with potentials shallower than quadratic. They are considered to form via parametric resonance during the preheating stage after inflation and serve as localized storagies of the inflaton field's energy. Due to their extended lifetimes, oscillons may play a significant role in the early universe, particularly during the reheating phase. However, estimating their lifespan is complicated by the interactions of the inflaton field with other fields, which is natural in realistic reheating scenarios.

In this study, we investigate how a coupled external real scalar field affects the decay and lifespan of an individual oscillon. By numerically computing the instability bands of the external field with the inhomogeneous oscillon profile as background, we show that the resonance behavior depends intricately on the shape of the oscillon profile. Different instability mechanisms can dominate in different ranges of the coupling strength. Especially, as the oscillon loses energy, the exponential growth of the external field may cease before the oscillon reaches its critical energy for collapse. Furthermore, our simulations indicate that though energy can be efficiently extracted from the oscillon through coupling to the external field, this does not necessarily lead to its destruction even under strong coupling or large amplitudes of the external field. These results suggest that oscillons can remain long-lived across a wide range of coupling strengths, with potential implications for their role in cosmological evolution.

Presenter: LI, Siyao (IBS CTPU-CGA)

Session Classification: Parallel 1