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Multi-field oscillons

Oscillons are oscillating, localized configurations in real scalar field theories. They appear in potentials that are shallower than quadratic away from the minimum and can be extremely long-lived.

Since plateau models are of great relevance for inflation, oscillons have been shown to form efficiently during preheating in a wide range of such models. Their formation and decay are accompanied by a characteristic GW signature which makes them particularly interesting from an experimental point of view.

Most work on oscillons has focused on single-field dynamics, however, various theories of fundamental physics that go beyond the Standard Model suggest the presence of a multitude of scalar fields in the early Universe. In this talk, I will describe the work I performed on the dynamics of oscillons in multi-field theories.

In particular, I will show how to construct multi-field oscillons in the non-relativistic limit of scalar field theories, and use this formalism to explain the origin of their stability and long lifetimes in a specific model with an exchange symmetry. I will talk about my most recent work in which I show that instabilities in the quantum vacuum can naturally lead to the condensation of multi-field oscillons. This is of special interest in the context of preheating scenarios, but could also find other applications in cosmology.

Finally, I will comment on strategies for generalizing this work to other models, for example, models with an arbitrary number of fields.

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