JOINT TUFTS/MIT COSMOLOGY SEMINAR

Beyond Simple Oscillons: Multi-Field Effects and Excited States

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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.
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. Furthermore, little is known about the dynamics of excited states of single-field oscillons in models that have garnered much attention historically. In this talk, I will describe the work I performed on the dynamics of excited and multi-component oscillons.
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 toy model. 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. I will comment on strategies for generalizing this work to other models, for example, models with an arbitrary number of fields. Finally, I will talk about excited oscillon states in the Sine-Gordon model, where, surprisingly, excited oscillons could have lifetimes that are comparable to the ground state oscillon.

Tuesday, December 6, 2022, 2:30 pm
574 Boston Ave, Room 310
Tufts University
Refreshments at 2:00 outside room 304