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Dynamical behaviors of defect filaments in Defect-mediated dust acoustic wave turbulence

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With increasing external driving, the transition of an ordered wave to the wave turbulent state through the intermediate weakly disordered state is a universal phenomenon in many extended nonlinear media such as acoustic, plasma, and optical system. Through modulation instability, the waveforms in the weakly disordered states are spatiotemporally modulated, which causes the generation of defect filaments, where amplitudes are null and phases are undefined. It also leads to the name defect-mediated turbulence (DMT) for the weakly disordered wave state[1].

In acoustic type waves, the defect filament served as the core of the acoustic vortex, i.e. the core winded around by the helical waveform. Similar to vortex filaments in the cores of vortices in hydrodynamic systems, defect filaments can interact with one another[2]. Those singular objects which can be used for characterizing the dynamics of the DMT states for nonlinear waves. However, their generic dynamical behaviors are still unexplored.

The dust acoustic wave is a paradigm of nonlinear acoustic type waves for investing the above behaviors due to the capability of direct visualization of dust motion over a large area. In this talk, we briefly review our past studies on observation and topological origins of the generation and annihilation of single to multiple defect filaments[3,4,5], our current studies on the morphology, interaction of defect filaments and the comparison with the generic behaviors of filaments in other nonlinear disordered systems.

References

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