Modulational instability of dust acoustic waves in strongly coupled Yukawa System

Sandip Dalui[1], Prince Kumar[1,2], Devendra Sharma[1,2]

[1] Institute for Plasma Research, HBNI, Bhat, Gandhinagar 382428, India, [2] Homi Bhabha National Institute, Training School Complex, Anushaktinagar, Mumbai 400094, India

e-mail (speaker): dalui.sandip77@gmail.com

Quasi-localized charge approximation (QLCA) [1] approach is a powerful formalism to investigate linear and nonlinear collective mode dispersions in strongly coupled Yukawa liquids. The modulational instability [2] of dust acoustic waves in strongly coupled Yukawa system consisting of negatively charged dust grains, and Maxwell-Boltzmann distribution of electrons and ions, have investigated within the QLCA framework. We have derived the linear dispersion relation and the nonlinear Schrödinger equation using reductive perturbation method. And consequently the nonlinear dispersion relation is derived to see the existence of modulational instability for strongly coupled Yukawa system. We have investigated both the cases, i.e., weakly and strongly coupled limit of the dusty plasma. In comparison with the weakly coupled limit of the Yukawa system, we have seen that the stable region increases due to the effect of the strongly coupled limit of the dusty plasma although a very small unstable domain in the parameter space also exists for strongly coupled dusty plasma system. We have seen that the region of existence of maximum modulational growth rate of instability increases with increasing dust temperature.

References

[1] Rosenberg M., Kalman G., Phys. Rev. E 1997, 56, 7166.
[2] Dalui S., Bandyopadhyay A., Das K. P., Phys. Plasmas 2017, 24, 042305.