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Effect of Dust Acoustic Wave on the evolution of Magneto-Rotational Instability

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Magneto-Rotational Instability (MRI) is a plasma instability which is considered to take place in a magnetized differentially rotating astrophysical disks. It is first proposed by Velikhov in 1959 and later by Chandrasekhar in 1960. Its importance in the astrophysical rotating disk was pointed out by Balbus and Hawley in 1991. This instability can generate MHD turbulence within a few periods of orbit and can generate a strong turbulent viscosity. Thus this instability is considered to play a major role in the context of accretion or in the context of planet formation which requires a strong viscous effect to transport angular momentum in the disk.
On the other hand, recent study has shown that the dust grains which carry about 1% of mass in the astrophysical matter can carry about 10^3 of negative charges through several atomic processes like collisions with charged electrons or ions and photoionization effect. As the charge-to-mass ratio of the charged dust grains is extremely small compared to that of electrons or ions, they behave as a new component of plasma and modify the behavior of plasma wave propagation and plasma instabilities.
We carried a linear analysis of multi-fluid plasma equations and studied the modification of MRI by the dust acoustic wave (DAW) modes which is excited by the existence of charged dust components. In this study, we assumed fully ionized multi-component plasma and included the effect of finite temperature. We found in the limit of parallel mode, the DAW may barely modify the behavior of MRI. In this presentation, we will discuss the effect of oblique mode of DAW on the linear evolution of MRI.

Keywords: Magneto-Rotational Instability, Accretion disks, MHD, Dusty Plasma, Plasma Instability