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ダスト音波の効果を入れた磁気回転不安定性の非線型発展
Non-Linear Evolution of Magneto-Rotational Instability under the effect of Dust Acoustic Wave mode

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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 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 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 carries 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. These new heavy plasma components may excite new dusty plasma wave modes in low frequency regime such as dust acoustic wave (DAW), and may modify behavior of plasma instabilities and plasma wave propagation.

Here, we perform both linear and non-linear analysis of multi-fluid plasma equations and study the modification of MRI by existence of charged-up dust particles. In this study, we assume fully ionized multi-component plasma with finite temperature to include the effect of dust acoustic wave (DAW). In the limit of parallel mode, we found the DAW may barely modify the behavior of MRI. On the other hand, result from the linear simulation implied a coupling between MRI and DAW in the oblique mode of MRI.

In this presentation, we would like to discuss a behavior of MRI in the non-linear stage and the effect of dusty plasma with results from numerical simulation.

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