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The current driven instability in collisional dusty plasmas

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The presence of charged grains plays an important role in the astrophysical and space environment. For example, the spoke formation in Saturn's ring, the Jovian ring formation, and the formation of the protoplanetary disks are but a few examples for which dust dynamics plays an important role. The planets are understood to have formed from a disk of gas and dust orbiting around the protostars. The presence of charged grains in the planetary and interstellar medium causes the excitation of very low frequency Alfven waves. These waves provide an important physical mechanism for the transport of angular momentum and energy in differentially rotating dusty disks.

The dusty plasma in nature, is a mixture of electrons, ions, neutral and charged grains, and hydrogen gas. The probability of electrons colliding with the positively charged grain and ions colliding with the negatively charged grain is comparable and is much bigger than the electrons and ions colliding with the same sign grains. The presence of plasma current due to the relative motion between the charged species in a collisional dusty plasma may destabilize the waves in the medium notwithstanding the dissipative loss of free energy. We investigate the current driven instability in the collisional dusty medium. The results are discussed in the context of various space plasma settings.