Plasma turbulence associated with artificial dusty space plasmas

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An alternate approach to understanding natural dust layers is to perform active space experiments in which a dust cloud is created in a controlled manner in the upper atmosphere. Its evolution can then be more carefully observed and studied and then compared to characteristics of natural dust clouds. Such experiments are currently under development are planned for the near future. A comparison of natural and artificially created dust clouds is expected to be quite enlightening and lead to more insight into the physical processes associated with natural dust clouds. Several important issues to be investigated include dust charging processes, plasma flows, electrodynamic structure, plasma irregularities, and coupling between the neutral components of the upper atmosphere and the dust clouds. Also possibilities of remote sensing plasma processes in these clouds through radar measurements will be studied. This talk will address some of the physical processes expected to be important during the early time phase after creation of an artificial dust cloud in the earth's ionosphere. Of principal importance will be the production of plasma irregularities which may lead to radar echoes and the possibility of their relationship to PMSEs observed from natural dusty space plasmas. First, a plasma model will be described that may be used for investigating early time evolution after expansion of an artificial dust cloud across the magnetic field in the ionosphere. This model will then be used to investigate the electrodynamics and possible plasma irregularity generation mechanisms after creation of an artificial dust cloud. Finally, possibilities of radar signatures observed from the dust cloud will be considered.