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Steady equilibrium co-rotating dust vortices in complex plasma
MODHUCHANDRA SINGH LAISHRAM, DEVENDRA SHARMA, KAW P.K., Inst. for Plasma Research — Dust clouds suspended in a plasma represent the simplest model for various living/active systems of nature which are inherently complex and thermodynamic non-equilibrium. Dynamics of such dust clouds confined in an axis symmetric cylindrical setup and in dynamic equilibrium with the background plasma is analyzed using hydrodynamic formulation for wide range of Reynolds numbers(Re). It revealed that any non-conservative forces associated with a species in a complex flow causes vortex flow of another slowly moving species in the system. Also in the nonlinear regimes(high Re), the dust flow structure mainly depend on the Re and aspect ratio (L_z/L_r) of the confined domain. For ($L_z : L_r \geq 1$), the flow structure is characterized by symmetric and elongated circulation at linear regime (low Re), and is turned into new antisymmetric pattern in nonlinear regime (high Re). Further increase in Re produce a spontaneous structural change through a critical parameter Re* by the nonlinear phenomena called structural bifurcation. Then the flow structure spontaneously turn into a system of identical structure co-rotating vertices's of almost uniform core region and surrounded by shear layers.

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