Ion-Streaming Induced Order Transition in Multi-Component Dusty Plasmas

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Dust Dynamics Simulations utilizing a dynamical screening approach are performed to study the effect of ion-streaming on the self-organized structures in a 3D spherically confined complex (dusty) plasma [1-4]. Varying the Mach number M, the ratio of ion drift velocity to the sound velocity, the simulations reproduce the experimentally observed cluster configurations in the two limiting cases: at M=0 strongly correlated crystalline structures consisting of *nested spherical shells (Yukawa balls)* and, for $M \geq 1$, *flow-aligned* dust chains. In addition, our simulations reveal a discontinuous transition between these two limits. It is found that even a moderate ion drift velocity ($M \approx 0.1$) destabilizes the highly ordered Yukawa balls and initiates an abrupt melting transition. The critical value of M is found to be independent of the cluster size. A similar streaming-induced order transition is expected to exist also in unconfined multicomponent dusty and quantum plasmas [5,6].

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