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Collective Phenomena in Extended Particle Chains within a Complex Plasma TRUELL HYDE, JIE KONG, MUDI CHEN, KE QIAO, BRANDON HARRIS, ANGELA DOUGLASS, JORGE CARMONA REYES, LORIN MATTHEWS, CASPER - Baylor University — Examination of collective phenomena within dusty plasma allows investigation into the fundamental physics behind the strong correlation effects observed across a broad range of systems. Recently, research into the micro-excitations of dust in vertical chain bundles has increased due to interest in other 2+1 D liquids sharing similar characteristics. This is particularly true for systems providing external field alignment of the bundle. Most such chain motion is created due to (a) strong vertical interparticle coupling creating particle alignment within the chain, (b) topological constraints arising from the structure of the confinement and (c) thermal perturbations and/or local strain-induced stresses which can induce particle hopping and overall chain motion. This paper will discuss the manner in which strong vertical and horizontal coupling tends to align vertical chain bundles and the topological constraints that arise from the resulting anisotropic confinement. Employing a glass box placed on the lower electrode of a GEC rf reference cell, a vertical dust chain bundle will be shown to undergo phase transitions from a single 1D vertical chain to a 2-fold zigzag structure to 3-, 4-, and 5-fold helical structures. Both theoretical and experimental results will be presented to better define the role the vertical interparticle force and overall system confinement plays in the physics underlying overall chain behavior.

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