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Field-driven mesoscale phase transition in polarized colloids in microgravity[1] BORIS KHUSID, EZINWA ELELE, New Jersey Institute of Technology, Newark, NJ — An unexpected phase transition in a polarized suspension was reported by Kumar, Khusid, Acrivos, PRL95, 258301, 2005 and Agarwal, Yethiraj, PRL102, 198301, 2009. Following the field application, particles aggregated head-to-tail into chains that bridged the interelectrode gap and then formed a cellular pattern, in which large-scale particle-free voids were enclosed by particle-rich thin walls. Surprisingly, the size of particle-free domains scales linearly with the gap thickness but is insensitive to the particle size and the field strength and frequency. Cellular structures were not observed in simulations of equilibrium in a polarized suspension (Richardi, Weis, J Chem Phys 135, 124502, 2011; Almudallal, Saika-Voivod, PRE 84, 011402, 2011). Nonequilibrium simulations (Park, Saintillan, PRE 83, 041409, 2011) showed cellular-like structures but at a particle concentration much higher than in experiments. A requirement for precise matching of densities between particles and a fluid to avoid gravity effects limits terrestrial experiments to negatively polarized particles. We will present data on positively polarized non-buoyancy-matched particles and the development of experiments in the International Space Station needed to evaluate gravity contribution.

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