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**Assembly of Spherical Colloids by Short-range Out-of-plane Attraction and Long-range In-plane Repulsion** FUDUO MA, DAVID T. WU, NING WU, Colorado School of Mines — The electric-field assembly of spherical colloids with isotropic surface properties has been studied in both two- and three-dimensions. Structures, such as FCC, HCP, and BCT crystals were observed. Recently, we have found surprisingly new types of structures within a previously unexplored experimental regime: low frequency regime (100 Hz to 10 kHz) and low salt concentrations (below $10^{-4}$ M). At low particle concentrations, a family of well-defined clusters, ranging from 3 to 10 was observed. Statistical analysis of the population distribution reveled non-trivial peaks for trimers, tetramers, hexamers, and nonamers. We attribute these new types of non-planar structures to a short-range out-of-plane (the plane refers to the substrate) attraction and a long-range in-plane repulsion. For example, the double layer and in-plane dipolar repulsion could make bottom particles in the clusters separate from each other. While the out-of-plane dipolar attraction and particle-substrate attraction could be responsible for the formation of the clusters, i.e., the top central sphere is associated with the bottom spheres. Phase diagrams from experiments and simulation will be compared. These clusters could be used as building blocks for making photonic crystal, filtration, and plasmonic structures.

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