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Self-Assembly of Amphiphilic Colloids

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A rich physics appears when spherical particles in aqueous suspension possess patches of different surface chemical composition. We have explored the assembly of two types of micron-sized spherical particles: those with opposite electric charge on both hemispheres ("bipolar") and those hydrophobic on one hemisphere and hydrophilic on the other ("amphiphilic"). Bipolar particles form clusters, not strings, because the particle diameter exceeds the electrostatic screening length. The cluster shapes are analyzed by combined epifluorescence microscopy and Monte Carlo computer simulations with excellent agreement, indicating that the particles assemble in aqueous suspension to form equilibrated aggregates. Translational and rotational diffusion are resolved at the single-particle level, with surprising conclusions. Work performed with Erik Luijten, Liang Hong, Angelo Cacciuto, Shan Jiang, Stephen Anthony, Minsu Kim, and Sung Chul Bae.