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Colloidal interactions and self-assembly of plasmonic metal pyramids in nematic liquid crystals. SUNGOH PARK, IVAN SMALYUKH, Department of Physics, University of Colorado at Boulder — Combining ordered structure of soft matter systems, such as liquid crystals, with the unique optical properties of metal nano- and micro-particles is a promising approach of designing and realizing mesostructured composites with pre-engineered properties. In this work, we disperse nanofabricated pyramid-shaped plasmonic particles in a nematic host fluid and demonstrate that the particles spontaneously align with respect to the uniform far-field liquid crystal director. This alignment is driven by minimization of the surface anchoring and bulk elastic free energies of the nematic host. Interestingly, multiple stable and metastable orientations of these particles can be controllably observed. Using laser tweezers and video microscopy, we explore inter-particle pair interaction forces as well as the ensuing colloidal self-assembly. We analyze this experimentally observed rich physical behavior of our soft matter composite by invoking electrostatic multipole analogy of elastic distortions induced by the particles in a nematic liquid crystal host and discuss potential practical uses.

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