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Elasto-capillary interactions between solid spheres at smectic thin films MOHAMED A. GHARBI, RANDALL D. KAMIEN, Department of Physics and Astronomy. University of Pennsylvania, SHU YANG, Department of Materials Science and Engineering. University of Pennsylvania, KATHLEEN J. STEBE, Department of Chemical and Biomolecular Engineering. University of Pennsylvania — Colloidal particles organize spontaneously at fluid interfaces owing to a variety of interactions to form well organized structures that can be exploited to synthesize advanced materials. While the physics of colloidal assembly at isotropic interfaces is well understood, the mechanisms that govern interactions between particles at liquid crystal interfaces are not yet clearly established. In particular, smectic liquid crystal films offer important degrees of freedom that can be used to direct particles into new structures. In this work, we report the behavior of solid micrometric beads with homeotropic anchoring confined at interfaces of thin smectic films. We study the interactions and self-assembly of these particles in both supported and free standing films. When particles are captured in thin membranes, they induce distortions of the smectic interface to satisfy wetting properties at particle boundaries, leading to capillary interactions. These forces compete with elastic ones induced by the distortion of the smectic layers. The resulting potential drives assembly of the spheres into new different structures in a self-assembly process. Recent progress in understanding the mechanism of particle self-organization is presented.

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