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Colloidal Transport within Nematics with Arrays of Obstacles
KUI CHEN, OLIVIA GEBHARDT, Johns Hopkins Univ, GERMAN DRAZER, Rutgers University, DANIEL REICH, ROBERT LEHENY, Johns Hopkins Univ
— We have investigated the transport behavior of spherical colloidal particles suspended in the nematic liquid crystal 4-cyano-4'-pentylbiphenyl (5CB) within microfluidic arrays of cylindrical obstacles arranged in a square lattice. Homeotropic anchoring at the surfaces of the obstacles created periodic director-field patterns that strongly influenced the trajectories of the colloids, which had both planar and homeotropic anchoring, as they traversed the arrays under gravity. When the applied force was along a symmetry direction of the lattice, the particles moved parallel to the force but with pronounced modulations in their velocity due to the liquid-crystal-mediated interactions with the posts. With increasing angle between the force and symmetry direction, the particle trajectories underwent a transition in which their average velocity no longer followed the force and instead was parallel to the lattice symmetry direction. The point of this transition was dictated by the particle-post interactions, suggesting a potential new mechanism for particle separations.

Kui Chen
Johns Hopkins Univ

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