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Liquid droplets of cross-linked actin filaments KIMBERLY WEIRICH, James Franck Institute, University of Chicago, SHILADITYA BANERJEE, James Franck Institute, University of Chicago and Physics, University College London, KINJAL DASBISWAS, SURIYANARAYAN VAIKUNTANATHAN, MARGARET GARDEL, James Franck Institute, University of Chicago — Soft materials constructed from biomolecules self-assemble into a myriad of structures that work in concert to support cell physiology. One critical soft material is the actin cytoskeleton, a viscoelastic gel composed of cross-linked actin filaments. Although actin networks are primarily known for their elastic properties, which are crucial to regulating cell mechanics, the viscous behavior has been theorized to enable shape changes and flows. We experimentally demonstrate a fluid phase of cross-linked actin, where cross-linker condenses dilute short actin filaments into spindle-shaped droplets, or tactoids. Tactoids have shape dynamics consistent with a continuum model of liquid crystal droplets. The cross-linker, which acts as a long range attractive interaction, analogous to molecular cohesion, controls the tactoid shape and dynamics, which reports on the liquid's interfacial tension and viscosity. We investigate how the cross-linker properties and filament length influence the liquid properties. These results demonstrate a novel mechanism to control organization of the actin cytoskeleton and provide insight into design principles for complex, macromolecular liquid phases.

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