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Geometric disorder regulates dispersion in viscoelastic porous media flows DEREK M. WALKAMA, NICOLAS WAISBORD, JEFFREY S. GUASTO, Tufts University — In this work, we study the dispersion of microparticles in viscoelastic fluid flow through model, microfluidic porous media, comprising arrays of either hexagonally ordered or randomly disordered pillars. Similar to previous work at high Peclet number, we show that a viscoelastic flow instability in the ordered medium enhances dispersion transverse to the mean flow direction with increasing Weissenberg number (Wi). In contrast, we demonstrate that geometric disorder has two main consequences for transport: First, disorder quenches the elastic instability and thus, suppresses transverse dispersion due to a lack of chaotic velocity fluctuations. Second, we observe an enhancement of longitudinal dispersion, which corresponds with the emergence of channelized flow within the disordered medium. These filamentous flows strengthen in intensity with increasing Wi, where the origin of the increased longitudinal transport stems from their strongly-correlated streamwise flow speed.

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