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Microscopic rearrangements and macroscopic stress fluctuations in dense emulsion flow DANDAN CHEN, KENNETH W. DESMOND, ERIC R. WEEKS, Emory University — One characteristic of dense granular materials is they can resist small stresses but start to flow under large stresses. During granular flow, the stress exerted on the boundaries of the flow can have large fluctuations. These fluctuations are thought to originate from internal rearrangements and from changes of force chains; however, the connection between these internal microscopic changes and the macroscopic influences seen at the boundaries is not yet clear. We experimentally study the shear flow of oil-in-water emulsion droplets in a Hele-Shaw cell with a hopper shape. Due to the thinness of the Hele-Shaw cell, the droplets are deformed into quasi-2D pancakes, somewhat analogous to soft photoelastic disks. As droplets approach the hopper exit, they shear past one another and droplets are forced to rearrange. We focus on a typical plastic rearrangement called T1 event, where local four particles have neighbor exchanges. Simultaneously, we use the deformation of the droplets to determine the interdroplet forces, which also change as the sample is sheared. These forces fluctuate over large regions as expected. Our analysis of this emulsion system shows a direct and local relationship between microscopic T1 rearrangements and macroscopic stress fluctuations.

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