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Yielding, Plasticity, and Microstructure in a 2D Jammed Material under Shear Deformation PAULO ARRATIA, NATHAN KEIM[1], University of Pennsylvania — In this talk, we discuss an experimental investigation on the yielding and plastic deformation of disordered solids. Experiments are performed on colloidal particles that are adsorbed at an oil-water interface and form a dense disordered monolayer. The rheological properties (G', G") of this dense monolayer are obtained in a custom-built interfacial stress rheometer that uses a magnetic needle within the material. This configuration allows for the simultaneous characterization of both microstructure (tracking $\sim 10^5$ particles) and bulk rheology. Results show that for oscillatory shear below a certain strain amplitude, the microstructure becomes reversible after a transient. Above this strain amplitude, the microstructure continues to evolve through many irreversible events. We argue that this boundary between a reversible and irreversible steady state is a yielding transition, and that our experiments measure a meaningful yield stress. Further, we find that reversible plastic deformation is possible. That is, the material can reorganize itself so that the link between plasticity and irreversibility is broken: the material flows slightly, and yet at the end of each deformation cycle, it is exactly unchanged.

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