

Probing Memory Formation in a Two-dimensional Amorphous Solid

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Abstract: Memory can be formed in disordered materials undergoing plastic deformations. In our experiments, we built and tested an interfacial shear rheometer to investigate memory formation in 2D colloids. We prepare a soft, frictionless amorphous solid composed of bidisperse colloidal particles at an oil-water interface. By putting the material through cycles of shear deformation, we can form and extract memories of strain amplitudes. Microscopically, memory behaviors arise from the physics of local particle rearrangements, which we study by tracking particle trajectories. While the dominant effect is the same return-point memory as exhibited by ferromagnets, some memory behaviors may arise only from interactions between rearrangements that are specific to amorphous solids. We perform tests that use asymmetric shear and amplitude variation to isolate the effects of these interactions.