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Emergence of cooperativity in plasticity of soft glassy materials

JÉRÔME CRASSOUS, ANTOINE LE BOUIL, AXELLE AMON, SEAN MCNAMARA, University Rennes 1 - IPR UMR CNRS 6251, France — The elastic coupling between plastic events is generally invoked to interpret plastic properties and failure of amorphous soft glassy materials. We report an experiment where we observe that plastic zones form structures of growing size as the system approaches failure. For this we impose a homogeneous stress on a granular material, and measure local deformations for very small strain increments using a light scattering setup. We observe non-homogeneous strains that appear as small line segments of mesoscopic size that lengthen as the system approaches failure. The line segments have a well defined orientation clearly distinct from macroscopic shear band that appears at failure. The presence and the orientation of those localized deformations may be understood by considering how a localized plastic reorganizations redistribute stresses in a surrounding continuous elastic medium. The mesostructure of the plastic deformation before failure and the presence of plastic events are confirmed by numerical simulations.

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