Time dependent elastic response to a local shear transformation in amorphous solids

Francesco Puosi, Université Grenoble 1

Jean-Louis Barrat, Université Grenoble 1

The elastic response of a two-dimensional amorphous solid to induced local shear transformations, which mimic the elementary plastic events occurring in deformed glasses [1, 2, 3], is investigated via Molecular Dynamics simulations. We show that for different spatial realizations of the transformation, despite relative fluctuations of order one, the long time equilibrium response averages out to the prediction of the Eshelby inclusion problem for a continuum elastic medium [4]. We characterize the effects of the underlying dynamics on the propagation of the elastic signal. A crossover from a propagative transmission in the case of weakly-damped dynamics to a diffusive transmission for strong damping is evidenced. In the latter case, the full time dependent elastic response is in surprising agreement with the theoretical prediction, obtained solving the diffusion equation for the displacement field in an elastic medium.

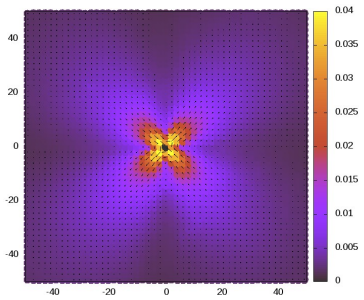

Figure 1: Long time mean displacement field $\langle \mathbf{u}_\infty \rangle$ after a local shear transformation (in the origin) obtained averaging over realization in different regions of the system.

Références

[1] A.S. Argon, H.Y. Kuo, Mater. Sci. Eng, **39**, 101 (1979).

[2] M.L. Falk, J.S. Langer, Phys. Rev. E, **57**, 7192 (1988).

[3] A. Tanguy, F. Leonforte, J.-L. Barrat, Eur. Phys. J. E, **20**, 355 (2006).

[4] J.D. Eshelby, Proc. R. Soc. London A, **241**, 376 (1957).

Francesco Puosi, Univ. Grenoble 1/CNRS, LIPhy UMR 5588, Grenoble, F-38041, France
francesco.puosi@ujf-grenoble.fr
Jean-Louis Barrat, Univ. Grenoble 1/CNRS, LIPhy UMR 5588, Grenoble, F-38041, France
jean-louis.barrat@ujf-grenoble.fr