Master 2 INTERNSHIP PROPOSAL

(One page maximum)

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Yielding and shear-banding in glasses: a mesoscopic approach

Due to their disordered structure and their out-of-equilibrium nature, glassy materials exhibit a rich and complex mechanical behavior: scale-free avalanches, localization of the plastic deformation into thin shear-bands but also a high dependence on the thermal and the mechanical history. In parallel with the numerous studies perfomed at the atomic or molecular scale a new class of meso-scale models has emerged in the recent years. In the spirit of the Ising model for magnetism or cellular automata for granular avalanches, these extremely simplified lattice models rely on very simple hypotheses, here a local threshold dynamics and an elastic interaction[1].

Despite many efforts, the precise status of the yielding transition (the onset of plasticity) in glasses and disordered solids is still unclear[2]. Analogies have been performed with the depinning of an elastic line in a random media[3] or the Random Field Ising Model[4]. Here, in the spirit of Ref. [2] we propose to use ideas and methods initially developed in the context of spin glasses to explore the status of the yielding transition in the framework of lattice mesocopic models of amorphous plasticity.

References :

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[4] M. Ozawa et al., Random critical point separates brittle and ductile yielding transitions in amorphous materials PNAS 115, 6656 (2018)

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Theoretical Physics, Statistical Physics, Numerical Physics, Soft Matter