Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Solids under Stress: Lessons from Simple Problems of Elastic String Depinning STEFANOS PAPANIKOLAOU, Yale University — When stress is applied on solid structures, deformation ultimately becomes permanent/plastic. Plasticity at the mesoscale proceeds through abrupt events, naturally resembling the jumps that a rubber band makes when driven through a landscape of pins. Elastic string depinning has been a very useful analogy for elucidating the statistical character of either crystalline or amorphous plasticity. Recent experiments and simulations, however, point out that the analogy is not complete, as naturally expected: In crystals, plasticity-mediating dislocation defects may "jump" through multiple slow relaxation channels beyond the fast gliding one. In amorphous solids, the "pins" for each particle have dynamics that may not be neglected since they correspond to neighboring particles. For each case, I will describe a generalized depinning model that aims to minimally include the additional physical mechanism and then compare to recent experiments and simulations. These simple depinning models suggest that plasticity of solids may cross-over to a state of stochastic relaxation oscillations through a mechanism that resembles a singular Hopf bifurcation.

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Date submitted: 07 Nov 2013 Electronic form version 1.4