Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Smooth versus jerky motion of packets of dislocations across fields of obstacles. CATALIN PICU, RENGE LI, Rensselaer Polytechnic Institute — We report on the transition from smooth ("unzipping") to jerky motion of multiple interacting dislocations (elastic manifolds) moving across a field of randomly located obstacles under constant applied stress. The transition is controlled by the stress, the obstacle strength and distribution. The system exhibits spatial and temporal correlations (intermittency) similar to those observed experimentally at much larger scale in dislocation avalanches. Power law distributions of jump amplitudes and separation times emerge. Comparison of the simulation results with experimental data indicates that the jerky motion is more relevant for plastic deformation of real crystals than unzipping. The strain rate sensitivity parameter, m, decreases sharply when the system enters the jerky mode and becomes independent of the obstacle strength, presence of obstacles of various strengths and the way those are mixed, and of temperature.

Catalin Picu
Rensselaer Polytechnic Institute

Date submitted: 20 Nov 2008 Electronic form version 1.4