Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Dependence of relaxation time on effective temperature in driven glasses[1] THOMAS HAXTON, Physics Dept., Univ. of Pennsylvania, AJAY GOPINATHAN, Physics Dept., Univ. of California, Santa Barbara, ANDREA LIU, Physics Dept, Univ. of Pennsylvania — Relaxation times of a class of driven glassy systems are shown to depend on a well-defined effective temperature in much the same way that they depend on temperature in quiescent systems. Molecular dynamics simulations were run for two-dimensional systems of bi-disperse spheres interacting via soft repulsive pair potentials. At high density the systems undergo a glass transition as temperature is lowered. We study low-temperature systems driven by an imposed shear gradient in steady state at a fixed high density. Effective temperatures can be defined from fluctuation-dissipation relations by the long-time limit of the ratio of correlation to response. Throughout a range of bath temperatures and shear rates, relaxation times are found to depend only on the bath temperature T and the effective temperature T_{eff}. In particular, the relaxation time of the driven system as a function of T_{eff} can be mapped on to the relaxation time of the quiescent system as a function of T, using a scale factor that varies only weakly with the ratio T/T_{eff}. This suggests that shear unjams the system because it gives rise to a T_{eff} that is higher than the glass transition temperature.

[1]This work was supported by DOE grant DE-FG02-03ER46087.

Thomas Haxton
Physics Dept., Univ. of Pennsylvania

Date submitted: 29 Nov 2005 Electronic form version 1.4