Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Structure and dynamics of a vibrated granular bead-chain KEVIN SAFFORD, ARSHAD KUDROLLI, Clark Univ. Physics Dept., YACOV KANTOR, Tel Aviv Univ. Physics Dept., MEHRAN KARDAR, MIT Physics Dept. — We investigate the dynamics of a vibrated granular bead-chain with experiments and numerical simulations of random-walk models of polymers. Experiments are conducted with a chain composed of hollow 3 mm steel beads connected by flexible links confined to move on a 300 mm diameter rough circular bed. Observations made with digital imaging. We analyze the radius of gyration R_g, the structure factor of the chain configurations, and the diffusion of the center of mass. We find that R_g and the structure factor scale with the exponent $\nu \sim 3/4$, consistent with the two dimensional self-avoiding random-walk model. Further, we observe confinement effects in the scaling of R_g as the chain length increases relative to the size of the container. We perform simulations of non-self-avoiding walks confined to the same sized domain and find good agreement with experiment. The simulations show confinement effects dominate over self-avoided crossings in the experiments even when the length of chain is smaller than system size. We then experimentally examine the chain dynamics and find that the center of mass diffusion scales inversely as the length of the chain, consistent with the Rouse model of polymers. We observe an exponential decay in the the dynamical structure factor and compare this exponent with the measurement of the center of mass diffusion.

Kevin Safford
Clark Univ.

Date submitted: 27 Nov 2007 Electronic form version 1.4