Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Elastic probes of length scales in jammed packings: from global response to point response KAMRAN KARIMI, CRAIG MALONEY, Carnegie Mellon University — We probe amorphous packings in different ways to determine whether or not characteristic length scales govern the elastic response and how these lengths depend on the area fraction of disks, ϕ. First we drive the system globally using either: i) a homogeneously deforming periodic cell of length L, ii) a force field having a plane-wave structure with wavelength L, iii) a homogeneously deforming rigid wall of length L. Methods i) and ii) give elastic moduli values that converge rapidly to the infinite system size limit and have ϕ-independent functional forms. Method iii), however shows a dramatic decrease in the shear modulus μ with increasing L. At low L, μ has a value that depends only weakly on ϕ, whereas, as L goes to infinity, μ must approach zero near jamming point ϕ_c. We show that the μ vs L curves at various ϕ can be collapsed into a master curve after scaling L by a quantity ξ that grows near ϕ_c. Secondly, we study the point response. We show that the response, in Fourier space, crossovers to the Kelvin solution for small wave vectors. This cross-over exhibits a lenghtscale that grows with ϕ in a similar fashion to the lengthscale determined by the global shear with a rigid box.

Kamran Karimi
Carnegie Mellon University

Date submitted: 15 Nov 2013 Electronic form version 1.4