Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

A phase diagram for jammed matter reveals the nature of the random loose and random close packing of spheres PING WANG, CHAOMING SONG, HERNAN A. MAKSE, Levich Institute and Department of Physics, City College of New York — We employ statistical mechanics of jammed matter to demonstrate the phase diagram of all available jammed configurations of frictional and frictionless granular packings. This provides a statistical definition of RLP and RCP, predicts their density values in close agreement with simulations, and establishes the concomitant equations of state relating observables such as the coordination number, z, entropy, S, and volume fraction, ϕ. We show that the RCP state is not a unique point in the phase space but extends along a line of zero compactivity, a temperature-like variable, predicted to be at a constant $\Phi_{RCP} = 0.634$, but with different z. The lowest density of RLP appears as a line of infinite compactivity parameterized by z, ending at the minimum possible density theoretically predicted to be $\Phi_{RLP} = 0.543$. The nature of the disorder of the packings is statistically characterized by the entropy which is shown to be larger in the random loose case than in the random close case.

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Date submitted: 26 Nov 2007 Electronic form version 1.4