Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Frustrated packing of monodisperse spheres in a flat container RALF STANNARIUS, KIRSTEN HARTH, Otto von Guericke University, Magdeburg — We study the packing of monodisperse spheres in a flat vertical box with cell gap slightly larger than the particle diameter, and evaluate the statistics of the particle arrangements. After 'gravitational' filling of the container and appropriate agitation, the particles form a nearly regular triangular lattice in the cell plane. The additional freedom of a displacement normal to the cell plane places the particles either at the front or rear cell plate. This leads to a denser arrangement in the cell plane, but at the same time causes frustrated states: Two of three neighboring beads in a local triangle have to occupy the same cell wall. Analogies to order in antiferroelectric Ising spin systems on a triangular lattice and to colloidal assemblies in thin layers are evident. We analyse experimental packings statistically and compare them to the predictions of models and Monte Carlo simulations. When the container is tilted from the vertical, the gravitational field mimics an external force similar to a magnetic field in spin systems. The experiment both offers insights into the influence of geometrical constraints on random packing, and provides a descriptive example of frustrated ordering.

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Date submitted: 14 Nov 2014 Electronic form version 1.4