

Analogies and differences between the dynamics of thin granular layers and equilibrium two-dimensional systems

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Abstract

We discuss in this work on the emergence of order in a thin layer of identical inelastic spheres. Grains are thermalized here by means of vertical vibration. Our system is highly confined (height smaller than 2 ball diameters; i.e., $h < 2\sigma$). From molecular dynamics results, we will show that, if realistic friction effects with the boundaries are taken into account, thermalization is only possible at high particle density. Moreover, at high densities, a rich phase phenomenology appears. In particular, in the case of a monolayer ($h \lesssim 1.75\sigma$) of inelastic hard spheres, strong analogies may appear [2] with the KTHNY theory for 2D equilibrium systems – the theory resulting from the works by Kosterlitz and Thouless and subsequent extensions by Halperin & Nelson, and Young [1].– However, we will see that the liquid-to-crystal transition phenomenology for soft inelastic spheres diverges from the KTHNY scenario, much like –but with important differences with– the case of elastic soft disks [3].

Keywords— granular dynamics; phase transitions

References

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