Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Solid-liquid-like transition in vibrated granular monolayers NICOLAS MUJICA, MARCEL CLERC, PATRICIO CORDERO, JOCELYN DUNSTAN, KATHRYN HUFF, LORETO OYARTE, RODRIGO SOTO, GERMAN VARAS, Departamento de Fisica, FCFM, Universidad de Chile, DINO RISSO, Departamento de Fisica, Facultad de Ciencias, Universidad del Bio-Bio — The theory of non-ideal gases in thermodynamic equilibrium, for instance the van der Waals gas model, has played a central role in the understanding of coexisting phases. Here, we report a combined experimental, numerical and theoretical study of a liquid-solid-like phase transition which takes place in a vertically vibrated fluidized granular monolayer. The first experimental setup is a long, narrow channel, with a width of the order of a few particle diameters, hence the dynamics is quasi-one-dimensional. We have considered this configuration to characterize the dynamic behavior of the phase transition. The second setup is used to measure the pressure as function of particle density in order to clarify the physical mechanism behind this phase transition. We demonstrate that the transition is mediated by waves and that it is triggered by a negative compressibility as in van der Waals phase coexistence, although the system does not satisfy the hypotheses used to understand atomic systems. Finally, in order to further characterize this phase transition, we study static and dynamic correlation functions, and bond-orientational order parameters.

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Date submitted: 04 Aug 2008 Electronic form version 1.4