Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Elastic weakening of a dense granular medium by acoustic fluidization XIAOPING JIA, JEROME LAURENT, Université Paris-Est, SIET WILDENBERG, MARTIN VAN HECKE, Universiteit Leiden, LPMDI TEAM, ONNES LAB TEAM — Elastic waves propagating through a dense granular pack provide a unique probe of the elastic properties and internal dissipation of the medium [1], and also allow investigating the irreversible rearrangement of the contact network at large vibration amplitude. In this talk, we describe two distinct types of nonlinearity, i.e. hertzian and frictional, at the grain contact by sound amplitude and velocity measurements, respectively, under different confining pressure [2]. Beyond certain wave amplitude, the sound-matter interaction becomes irreversible, leaving the medium in a weakened and slightly compacted state. A slow recovery of the initial elastic modulus is observed after acoustic perturbation, revealing the plastic creep growth of microcontacts. The cross-correlation function of configuration-specific acoustic speckles highlights the relationship between the macroscopic elastic weakening and the local change of the contact networks, induced by strong sound vibration, in the absence of appreciable grain motion. We show that the softening of elastic modulus is much more pronounced with the shear wave (up to 20%) than with the compressional wave (to 10%).

[1] Th. Brunet, X. Jia and P. Mills, Phys. Rev. Lett **101**, 138001 (2008)
[2] Th. Brunet, X. Jia and P. Johnson, Geophys. Res. Lett **35**, L19308 (2008); X. Jia, Th. Brunet and J. Laurent, Phys. Rev. E **00**, 000300(R) (2011)

Xiaoping Jia
Université Paris-Est

Date submitted: 16 Nov 2011 Electronic form version 1.4