Revealing the structure of a granular medium through ballistic sound propagation

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We study the propagation of sound through a two-dimensional granular medium consisting of photoelastic disks, which are packed into different crystalline and disordered structures. Acoustic sensors placed at the boundaries of the system capture the acoustic signal produced by a local and well-controlled mechanical excitation. By compressing the system we find that the speed of the ballistic part of the acoustic wave behaves as a power law of the applied force with both exponent and prefactor sensitive to the internal geometry of the contact network. This information, which we are able to link to the force-deformation relation of single grains under different contact geometries, provides enough information to reveal the structure of the granular medium.

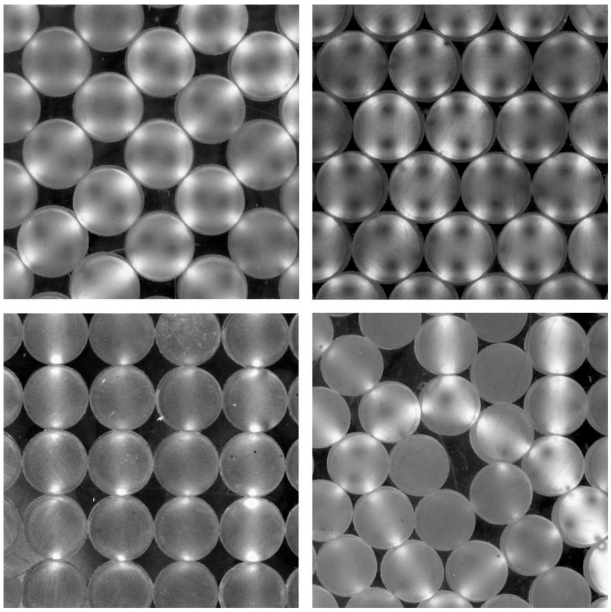

Figure 1: Optical detection of contact points (bright spots) for the propagation of acoustic waves within a monolayer of compressed translucent disks in four different structures. Figure extracted from [1].

[1] S. Lherminier, R. Planet, G. Simon, L. Vanel, and O. Ramos, Phys. Rev. Lett. **113**, 098001 (2014).